

07122 Abstracts Collection
Normative Multi-agent Systems
— Dagstuhl Seminar —

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Abstract. From 18.03.07 to 23.03.07, the Dagstuhl Seminar 07122 “Normative Multi-agent Systems” was held in the International Conference and Research Center (IBFI), Schloss Dagstuhl. 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. Normative systems, multi-agent systems

Introduction to Normative Multiagent Systems

Harko Verhagen (Stockholm University, S)

This article introduces the research issues related to and definition of normative multiagent systems.

Keywords: Norms, Multiagent systems, Normative multiagent systems

Joint work of: Boella, Guido; van der Torre, Leendert; Verhagen, Harko

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/918>

See also: G. Boella, L. van der Torre, and H. Verhagen. Introduction to Normative Multiagent Systems, Journal of Computational and Mathematical Organization Theory, 12 (2/3), p. 71 - 80, October 2006.

Norms of Conversation in a Framework for Agent Communication Languages

Rodrigo Agerri (University of Birmingham, GB)

In open and heterogeneous environments offered by the Internet, where agents are designed by different vendors, the development of standards for agent communication needs to keep abreast of new dynamic interaction modalities. The objective of this paper is to contribute to FIPA's standardization effort by proposing a pragmatic approach to the design of agent communication languages (ACLs) in which the meaning of messages is the combination of its semantics and pragmatics. First, we present a reformulation of FIPA's communicative acts (ACL semantics) using a grounded specification language which overcomes some of the usual problems attributed to FIPA's ACL semantics. Then the ACL pragmatics aims to account for the contextual factors that enriches the semantics, such agents' roles, turn-taking, and the satisfiability of messages' perlocutionary effects. We claim that the ACL pragmatics is best specified by means of norms related to agents' obligations, permissions and rights.

Keywords: Agent Communication Languages, Norms, Multi-Agent Systems

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/920>

On the Logic of Normative Systems

Thomas Ågotnes (Bergen University College, N)

We introduce *Normative Temporal Logic* (NTL), a logic for reasoning about normative systems. NTL is a generalisation of the well-known branching-time temporal logic CTL, in which the path quantifiers A ("on all paths...") and E ("on some path...") are replaced by the indexed deontic operators O_η and P_η , where for example $O_\eta\varphi$ means " φ is obligatory in the context of normative system η ".

After defining the logic, we give a sound and complete axiomatisation, and discuss the logic's relationship to standard deontic logics. We present a symbolic representation language for models and normative systems, and identify four different model checking problems, corresponding to whether or not a model is represented symbolically or explicitly, and whether or not we are given an interpretation for the normative systems named in formulae to be checked. We show that the complexity of model checking varies from P-complete up to EXPTIME-hard for these variations.

Keywords: Normative systems, normative temporal logic, deontic logic

Joint work of: Ågotnes, Thomas; van der Hoek, Wiebe; Rodriguez-Aguilar, Juan A.; Sierra, Carles; Wooldridge, Michael

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/921>

Expressing and Verifying Business Contracts with Abductive

Marco Alberti (Università di Ferrara, I)

In this article, we propose to adopt the SCIFF abductive logic language to specify business contracts, and show how its proof procedures are useful to verify contract execution and fulfilment.

SCIFF is a declarative language based on abductive logic programming, which accommodates forward rules, predicate definitions, and constraints over finite domain variables. Its declarative semantics is abductive, and can be related to that of deontic operators; its operational specification is the sound and complete SCIFF proof procedure, defined as a set of transition rules, which has been implemented and integrated into a reasoning and verification tool. A variation of the SCIFF proof-procedure (g-SCIFF) can be used for static verification of contract properties.

We demonstrate the use of the SCIFF language for business contract specification and verification, in a concrete scenario. In order to accommodate integration of SCIFF with architectures for business contract, we also propose an encoding of SCIFF contract rules in RuleML.

Keywords: Contracts, Verification, Abduction

Joint work of: Alberti, Marco; Chesani, Federico; Gavanelli, Marco; Lamma, Evelina; Mello, Paola; Montali, Marco; Torroni, Paolo

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/901>

A Game-Theoretic Approach to Normative Multi-Agent Systems

Guido Boella (University of Torino, I)

We explain the raison d'être and basic ideas of our game-theoretic approach to normative multiagent systems, sketching the central elements with pointers to other publications for detailed developments.

Keywords: Normative multiagent systems, deontic logic, input/output logic

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

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/937>

Normative Multi-Agent Organizations: Modeling, Support and Control, Draft Version

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

In the last years, social and organizational aspects of agency have become a major issue in multi-agent systems' research.

Recent applications of MAS enforce the need of using these aspects in order to ensure some social order within these systems. Tools to control and regulate the overall functioning of the system are needed in order to enforce global laws on the autonomous agents operating in it. This paper presents a normative organization system composed of a normative organization modeling language MOISEInst used to define the normative organization of a MAS, accompanied with SYNAI, a normative organization implementation architecture which is itself regulated with an explicit normative organization specification.

Keywords: Organization, multi-agent

Joint work of: Boissier, Olivier; Gâteau, Benjamin

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/902>

Spatially Distributed Normative Objects

Rafael Bordini (University of Durham, GB)

Organisational structures for multi-agent systems are usually defined independently of any spatial or temporal structure. Therefore, when the multiagent system is situated in a spatial environment, there is usually a conceptual gap between the definition of the system's organisational structures and the definition of the environment. In this paper, we focus on a mechanism for the spatial distribution of an organization's normative information. Spatially distributing the normative information over the environment is a natural way to simplify the definition of organisational structures and the development of large-scale multi-agent systems. By distributing the normative information in different spatial locations, we allow agents to directly access the relevant information needed in each environmental context. We extend our previous work on a language for modelling multi-agent environments in order to allow for the definition of spatially distributed norms in the form of normative objects.

Keywords: Multi-Agent Systems, Environment Modelling, Normative Infrastructure

Joint work of: Okuyama, Fabio; Bordini, Rafael; Rocha Costa, Antônio Carlos

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/903>

See also: F. Y. Okuyama, R. H. Bordini, and A. C. da Rocha Costa. Spatially Distributed Normative Objects. In G. Boella et al. (edts.), Proceedings of the International Workshop on Coordination, Organization, Institutions and Norms in Agent Systems (COIN), held with ECAI, Riva del Garda, Italy, 28 August 2006.

Designing Organizations: Towards a Model

Emanuele Bottazzi (Institute of Cognitive Sciences & Technology-Trent, I)

The purpose of this paper is to draw a preliminary model of an ontology of organizations. The emphasis is on the structural aspects of organizations and the relations that these have with the design process of the organization itself on the one hand, and with its normative layer on the other.

Keywords: Ontology, organizations, structure, design, norms

Joint work of: Bottazzi, Emanuele; Ferrario, Roberta; Masolo, Claudio; Trypuz, Robert

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/904>

What an Agent Ought To Do

Jan M. Broersen (Utrecht University, NL)

This paper reviews Horty's 2001 book 'Agency and Deontic Logic'. We place Horty's research in a broader context and discuss the relevancy for logics for multi-agent systems.

Keywords: Deontic logic, STIT, agency, action

Joint work of: Broersen, Jan M.; van der Torre, Leendert

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/905>

Full Paper:

<http://ipsapp007.kluweronline.com/ips/frames/frames.asp?J=4521&cookie=1>

A Normative Multi-Agent Systems Approach to the Use of Conviviality for Digital Cities

Patrice Caire (University of Luxemburg, L)

Conviviality is a mechanism to reinforce social cohesion and a tool to reduce miscoordination between individuals, groups and institutions in web communities, for example in digital cities. We use a two-fold definition of conviviality as a condition for social interactions and an instrument for the internal regulation of social systems. In this paper we discuss the use of normative multi-agent systems to analyze the use of conviviality for digital cities, by contrasting norms for conviviality with legal and institutional norms in digital cities. We show the role of the distinction among various kinds of norms, the explicit representation of norms, the violability of norms, the dynamics of norms and the creation of norms in the context of conviviality.

Keywords: Conviviality, multi-agent systems, normative systems, social computing, digital cities.

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/906>

Aligning Models of Normative Systems and Artificial Societies: Towards norm-governed behavior in virtual enterprises

Paul Davidson (Blekinge Institute of Technology - Karlskrona, S)

The purpose is to explore how norm-governed behavior within agent societies can be achieved in the context of Virtual Enterprises. We analyze a number of formal models from the agent research field, of which three models focus on the society aspects and three models focus on norms. A general observation is that the models reviewed are not concordant with each other and therefore require further alignment. A number of additions that may enrich the norm-focused models are suggested. It is also concluded that the introduction of different types of norms on different levels can be applied to ensure sound collaboration in agent-supported virtual enterprises. Moreover, the deployment of norm defender and promoter functionality is suggested to ensure norm compliance and punishments of norm violations.

Keywords: Agents, norms, virtual enterprises

Joint work of: Davidson, Paul; Jacobsson, Andreas

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/908>

Specifying and Enforcing Norms in Artificial Institutions

Nicoletta Fornara (University of Lugano, CH)

In this paper we investigate two important and related aspects of the formalization of open interaction systems: how to specify norms, and how to enforce them by means of sanctions. The problem of specifying the sanctions associated with the violation of norms is crucial in an open system because, given that the compliance of autonomous agents to obligations and prohibitions cannot be taken for granted, norm enforcement is necessary to constrain the possible evolutions of the system, thus obtaining a degree of predictability that makes it rational for agents to interact with the system. In our model, norms are specified declaratively. When certain events take place, norms become active and generate pending commitments for the agents playing certain roles. Norms also specify the sanctions associated with their violation. In the paper, we analyze the concept of sanction in detail and propose a mechanism through which sanctions can be applied.

Keywords: Norms, Sanctions, Commitments, Artificial Institutions

Joint work of: Fornara, Nicoletta; Colombetti, Marco

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/909>

Norms and plans as unification criteria for social collectives

Aldo Gangemi (Institute of Cognitive Sciences & Technology - Rom, I)

Based on the formal-ontological paradigm of Constructive Descriptions and Situations, we propose a definition of social collectives that includes social agents, plans, norms, and the conceptual relations between them. We also propose a typology of social collectives, including collection of agents, knowledge community, intentional collective, and intentional normative collective. Our ontology, represented as a first-order theory, provides the expressivity to talk about the contexts (social, informational, circumstantial, and epistemic), in which collectives make and produce sense

Keywords: Formal Ontology, Constructivism, Social Entities, Semantic Web

Joint work of: Gangemi, Aldo; Lehmann, Jos; Catenacci, Carola

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/910>

Deriving individual obligations from collective obligations

Christophe Garion (SUPAERO-Toulouse, F)

A collective obligation is an obligation directed to a group of agents so that the group, as a whole, is obliged to achieve a given task.

The problem investigated here is the impact of collective obligations to individual obligations, i.e. obligations directed to single agents of the group. The groups we consider do not have any particular hierarchical structure nor have an institutionalized representative agent. In this case, we claim that the derivation of individual obligations from collective obligations depends on several parameters among which the ability of the agents (i.e. what they can do) and their own personal commitments (i.e. what they are determined to do). As for checking if these obligations are fulfilled or not, we need to know what are the actual actions performed by the agents.

This present paper addresses these questions in the rather general case when the collective obligations are conditional ones.

Keywords: Deontic logic, action, representation of preferences

Joint work of: Garion, Christophe; Cholvy, Laurence

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/911>

See also: Proceedings of the Second International Joint Conference on Autonomous Agents and Multiagent Systems, pages 962-964 (Poster). ACM Press, 2003

Towards a General Framework for Modelling Roles

Valerio Genovese (University of Torino, I)

Role is a widespread concept, it is used in many areas like MAS, Programming Languages, Organizations, Security and OO modelling. Unfortunately, it seems that the literature is not actually able to give a uniform definition of roles, there exist several approaches that model roles in many different (or even opposite) ways. In this draft we start to define a meta-model for roles. Our aim is to build a formal framework through which we can describe different roles appeared in the literature or implemented in up and running computer systems. In particular we give a new definition of role's foundation introducing sessions, which are a formal instrument to talk about role's states and we show how sessions may be useful to model many different role's accounts.

Keywords: Roles, Organizations, Object Oriented Modelling, Multi-Agent Systems, Security

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/925>

BIO Logical Agents: Norms, Beliefs, Intentions in Defeasible Logic

Guido Governatori (The University of Queensland, AU)

In this paper we follow the BOID (Belief, Obligation, Intention, Desire) architecture to describe agents and agent types in Defeasible Logic. We argue, in particular, that the introduction of obligations can provide a new reading of the concepts of intention and intentionality. Then we examine the notion of social agent (i.e., an agent where obligations prevail over intentions) and discuss some computational and philosophical issues related to it.

We show that the notion of social agent either requires more complex computations or has some philosophical drawbacks.

Keywords: Social Agents, Defeasible Logic, Complexity of Agents

Joint work of: Governatori, Guido; Rotolo, Antonino

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/912>

On the logic of constitutive rules

Davide Grossi (Utrecht University, NL)

The paper proposes a logical systematization of the notion of counts-as which is grounded on a very simple intuition about what counts-as statements actually mean, i.e., forms of classification. Moving from this analytical thesis the paper disentangles three semantically different readings of statements of the type X counts as Y in context C, from the weaker notion of contextual classification to the stronger notion of constitutive rule. These many ways in which counts-as can be said are then formally addressed by making use of modal logic techniques. The resulting framework allows for a formal characterization of all the involved notions and their reciprocal logical relationships.

Keywords: Constitutive rules, counts-as, modal logic

Joint work of: Grossi, Davide; Meyer, John-Jules; Dignum, Frank

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/913>

Prioritized Conditional Imperatives: Problems and a New Proposal

Jörg Hansen (Universität Leipzig - ICCAS, D)

The sentences of deontic logic may be understood as describing what an agent ought to do when faced with a given set of norms. If these norms come into conflict, the best the agent can be expected to do is to follow a maximal subset of the norms. Intuitively, a priority ordering of the norms can be helpful in determining the relevant sets and resolve conflicts, but a formal resolution mechanism has been difficult to provide. In particular, reasoning about prioritized conditional imperatives is overshadowed by problems such as the ‘order puzzle’ that are not satisfactorily resolved by existing approaches. The paper provides a new proposal as to how these problems may be overcome.

Keywords: Deontic logic, default logic, priorities, logic of imperatives

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/914>

Control Patterns in a Health Care Network

Joris Hulstijn (Vrije Universiteit Amsterdam, NL)

In this paper we present control patterns for the analysis and design of administrative control mechanisms in a network organization.

A control pattern is a description of a generic and reusable control mechanism that solves a specific control problem, to be selected on the basis of the context. To represent the context and solution, we analyze a network organization as a set of actors who transfer objects of economic value. The usefulness and adequacy of the control patterns is demonstrated by a case study of the governance and control mechanisms of the Dutch public health insurance network for exceptional medical expenses (AWBZ).

Keywords: Governance and control, network organizations, value modeling

Joint work of: Kartseva, Vera; Hulstijn, Joris; Gordijn, Jaap; Tan, Yao-Hua

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/915>

Norms and accountability in multi-agent societies

Rodger Kibble (Goldsmiths College - London, GB)

It is argued that norms are best understood as classes of constraints on practical reasoning, which an agent may consult either to select appropriate goals or commitments according to the circumstances, or to construct a discursive justification for a course of action after the event.

We also discuss the question of how norm-conformance can be enforced in an open agent society, arguing that some form of peer pressure is needed in open agent societies lacking universally-recognised rules or any accepted authority structure. The paper includes formal specifications of some data structures that may be employed in reasoning about normative agents.

Keywords: Norms, agents, social commitments, reasoning

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/916>

A Normative Framework for Agent-Based Systems

Fabiola Lopez y Lopez (Benemérita Universidad Autónoma de Puebla, MEX)

One of the key issues in the computational representation of open societies relates to the introduction of norms that help to cope with the heterogeneity, the autonomy and the diversity of interests among their members. Research regarding this issue presents two omissions. One is the lack of a canonical model of norms that facilitates their implementation, and that allows us to describe the processes of reasoning about norms. The other refers to considering, in the model of normative multi-agent systems, the perspective of individual agents and what they might need to effectively reason about the society in which they participate. Both are the concerns of this paper, and the main objective is to present a formal normative framework for agent-based systems that facilitates their implementation.

Keywords: Normative agents, normative multi-agent systems

Joint work of: Lopez y Lopez, Fabiola; Luck, Michael; d'Inverno, Mark

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/933>

Full Paper:

<http://dx.doi.org/10.1007/s10588-006-9545-7>

See also: Computational & Mathematical Organization Theory. 12:227-250. Springer. 2006

Towards a Logic of Graded Normativity and Norm Adherence

Matthias Nickles (TU München, D)

A key focus of contemporary agent-oriented research and engineering is on open multiagent systems composed of truly autonomous, interacting agents. This poses new challenges, as entities in open systems are usually more or less mentally opaque (e.g., possibly insincere), and can enter and leave the system at will. Thus interactions among such black- or gray-box entities usually imply more or less severe contingencies in behavior: Among other issues, in principle, the adherence of agents to norms cannot be guaranteed in such systems. As a response to this issue, this paper proposes a logic-based approach based on the notion of (possibly probabilistic) behavioral expectations, which are stylized either as adaptive (i.e., predictive) or normative (i.e., prescriptive). Some features of this approach are the enabling of "soft norms" which are automatically weakened to some degree if contradicted at runtime, and the possibility to quantify norm adherence using the measurement of norm deviance.

Keywords: Computational Norms, Dynamic Logic, Computational Expectations, Social AI, Belief Revision

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/926>

Agents, Norms and Forest Cleaning

Jan Odelstad (University of Gävle, S)

The automation of forest cleaning presupposes principles for choosing those trees that ought to be taken away and those that shall be left standing. In this paper, which is a report on a work in progress, the question is raised whether those principles can be structured as a combination of a normative system and a utility function. Of special interest is the possibility that the agent system can evaluate the efficiency of the normative system and the utility function and, furthermore, suggest improvements of them. Earlier works on norms and norm-regulation of agent systems that the author has been involved in are used to elucidate the problem area discussed in the paper.

Keywords: Norm, normative system, norm-regulated agent, forest cleaning

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/917>

Emergence In the Loop: Simulating the two way dynamics of norm innovation

Mario Paolucci (ISTC-CNR - Rom, I)

In this paper we will present the EMIL project, "EMergence In the Loop: Simulating the two-way dynamics of norm innovation", a three-year project funded by the European Commission (Sixth Framework Programme -Information Society and Technologies) in the framework of the initiative "Simulating Emergent Properties in Complex Systems". The EMIL project intends to contribute to the study of social complex systems by modelling norm innovation as a phenomenon implying interrelationships among multiple levels. It shall endeavour to point out that social dynamics in societies of intelligent agents is necessarily bi-directional, which adds complexity to the emergence processes. The micro-macro link will be modelled and observed in the emergence of properties at the macro-level and their immergence into the micro-level units. The main scientific aim of the EMIL project is to construct a simulator for exploring and experimenting norm-innovation.

Keywords: Norm innovation, emergence, immergence, simulation, social complexity

Joint work of: Paolucci, Mario; Andrighetto, Giulia; Conte, Rosaria; Turrini, Paolo

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/907>

Ten Philosophical Problems in Deontic Logic

Gabriella Pigozzi (University of Luxemburg, L)

The paper discusses ten philosophical problems in deontic logic: how to formally represent norms, when a set of norms may be termed 'coherent', how to deal with normative conflicts, how contrary-to-duty obligations can be appropriately modeled, how dyadic deontic operators may be redefined to relate to sets of norms instead of preference relations between possible worlds, how various concepts of permission can be accommodated, how meaning postulates and counts-as conditionals can be taken into account, and how sets of norms may be revised and merged. The problems are discussed from the viewpoint of input/output logic as developed by van der Torre Makinson. We argue that norms, not ideality, should take the central position in deontic semantics, and that a semantics that represents norms, as input/output logic does, provides helpful tools for analyzing, clarifying and solving the problems of deontic logic.

Keywords: Deontic logic, normative systems, input/output logic

Joint work of: Hansen, Jörg; Pigozzi, Gabriella; van der Torre, Leendert

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/941>

Interaction between Normative Systems and Cognitive agents in Temporal Modal Defeasible Logic

Regis Riveret (Università di Bologna, I)

While some recent frameworks on cognitive agents addressed the combination of mental attitudes with deontic concepts, they commonly ignore the representation of time. We propose in this paper a variant of Temporal Modal Defeasible Logic to deal in particular with temporal intervals.

Keywords: Time, Norm, Temporal Modal Defeasible Logic

Joint work of: Riveret, Regis; Rotolo, Antonino; Governatori, Guido

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/923>

Implementing Norms that Govern Non-Dialogical Actions

Viviane Torres da Silva (Univ. Comp. de Madrid, E)

The governance of open multi-agent systems is particularly important since those systems are composed by heterogeneous, autonomous and independently designed agents. Such governance is usually provided by the establishment of norms that regulate the actions of agents. Although there are several approaches that formally describe norms, there are still few of them that propose their implementation. In addition, only one that provides support for implementing norms deals with non-dialogical actions since the others only deal with dialogical actions, i.e., actions that provide the interchange of messages between agents. In this paper we propose the implementation of norms that govern non-dialogical actions by extending one of the approaches that regulate dialogical ones. Non-dialogical actions are not related to the interactions between agents but to tasks executed by agents that characterize, for instance, the access to resources, their commitment to play roles or their movement into environments and organizations.

Keywords: Norm, governance of multi-agent system, non-dialogical action

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/927>

Normtypologies

Harko Verhagen (Stockholm University, S)

In this extended abstract I describe some norm typologies developed within sociology and social philosophy. Using these typologies we can determine the boundaries of the different approaches to normative agent systems.

Keywords: Norms, Multiagent systems, Normative multiagent systems

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/930>

Epistemic Norms in a Nutshell

Emil Weydert (University of Luxemburg, L)

We present some thoughts on epistemic norms.

Keywords: Epistemic norms, Trust, Meta-Science

Extended Abstract: <http://drops.dagstuhl.de/opus/volltexte/2007/924>

Choosing Your Beliefs

Célia da Costa Pereira (Università di Milano, I)

This paper presents and discusses a novel approach to indeterministic belief revision. An indeterministic belief revision operator assumes that, when an agent is confronted with a new piece of information, it can revise its belief sets in more than one way. We define a rational agent not only in terms of what it believes but also of what it desires and wants to achieve. Hence, we propose that the agent's goals play a role in the choice of (possibly) one of the several available revision options. Properties of the new belief revision mechanism are also investigated.

Keywords: Rational agents, indeterministic belief revision, qualitative decision theory

Joint work of: Boella, Guido; da Costa Pereira, Célia; Pigozzi, Gabriella; Tettamanzi, Andrea; van der Torre, Leendert

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/938>

What is Input/Output Logic? Input/Output Logic, Constraints, Permissions

Leon van der Torre (University of Luxemburg, L)

We explain the *raison d'être* and basic ideas of input/output logic, sketching the central elements with pointers to other publications for detailed developments. The motivation comes from the logic of norms. Unconstrained input/output operations are straightforward to define, with relatively simple behaviour, but ignore the subtleties of contrary-to-duty norms. To deal with these more sensitively, we constrain input/output operations by means of consistency conditions, expressed via the concept of an outfamily.

They also provide a convenient platform for distinguishing and analysing several different kinds of permission.

Keywords: Deontic logic, input/output logic, constraints, permissions

Joint work of: Makinson, David; van der Torre, Leendert

Full Paper: <http://drops.dagstuhl.de/opus/volltexte/2007/928>