

Trends in Logic XVIII

Fine-Grained Semantics for Modal Logic:

Formal and Foundational Issues

September 24th – 27th, 2018

Università Cattolica del Sacro Cuore di Milano

Conference Description

In the last few decades an impressive amount of foundational research in philosophical logic has been devoted to the development of semantical tools which provide sufficiently fine-grained semantics to deal with important topics of pure and applied modal logic, such as the representation of situations, states of affairs, structured contents, hyperintensional contexts, and agent-related attitudes, like epistemic and prohairetic attitudes. A number of different modal frameworks have emerged to tackle these themes such as:

- explicit semantics (developing syntactic approaches)
- situation semantics (developing possible worlds semantics)
- topological semantics (developing neighborhood semantics)
- truthmaker semantics (developing algebraic and states semantics)

The aim of this conference is to study the potential of these approaches and to explore new connections between them, by providing a forum to present new ideas and analytical methods. The conference consists of both logical contributions, providing novel solutions to crucial problems in the field, and foundational contributions, focusing on the conceptual frameworks underlying these approaches and the possibility of combining them.

Organization

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Conference Venue

The conference will take place at two sites of the Università Cattolica campus in the district of Sant’Ambrogio:

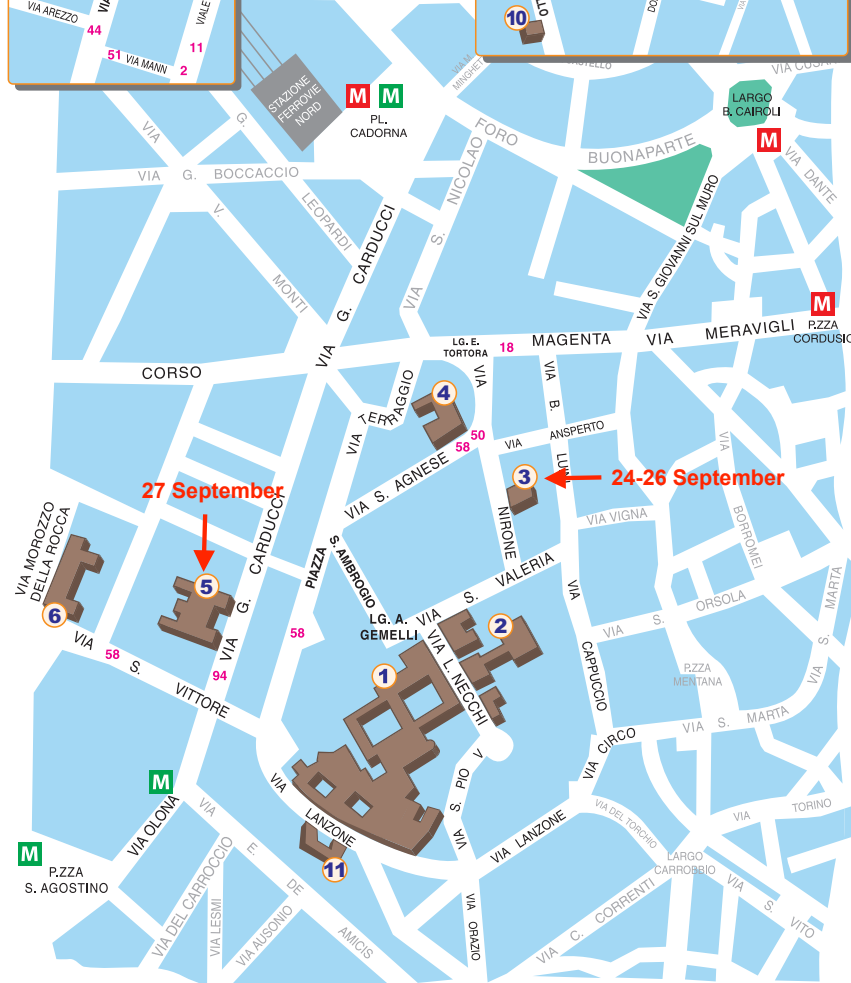
- via Nirone 15
 - * room NI.010-011 on September 24
 - * room NI.111-112 on September 25 – 26

- via Carducci 28/30
 - * room C.015 on September 27

Both sites are at walking distance from the stops “Cadorna” and “Sant’Ambrogio” of the metro line M2 (Cadorna station is closer to the site in via Nirone, while Sant’Ambrogio station is closer to the site in via Carducci). The next pages contain maps of the campus and of the buildings.

Sant'Ambrogio University Campus

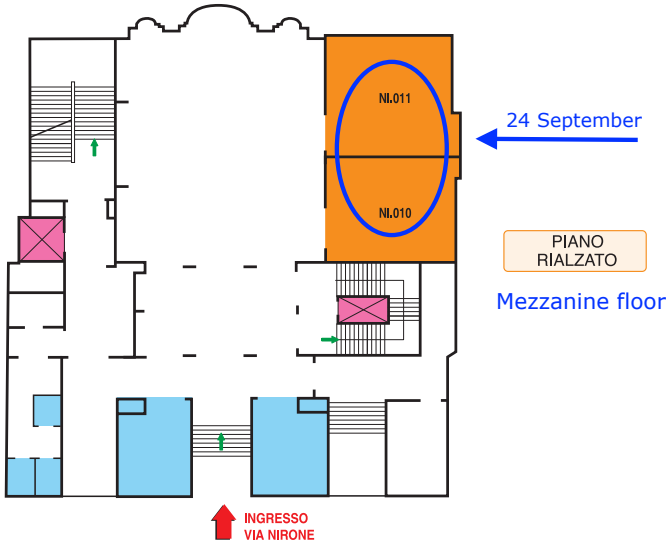
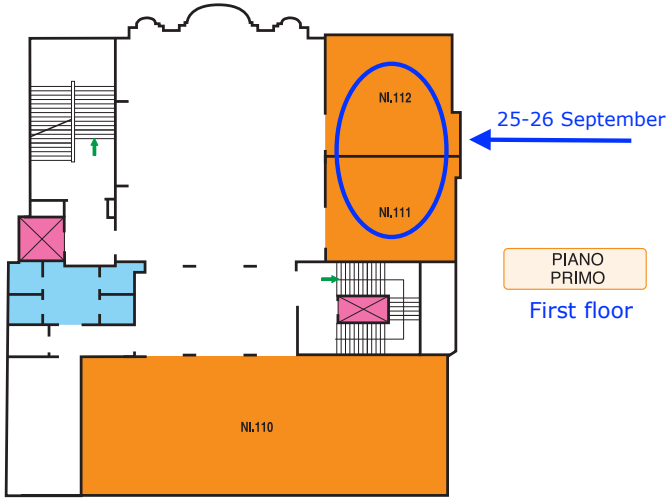
Mappa delle Sedi universitarie del Campus di Milano



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|------------------------------|--|---------------------------------------|
| ① Sede di Largo Gemelli, 1 | ⑤ Sede di Via G. Carducci, 28/30 | ⑨ Sede di Via Pagliano, 10 (R.I.M.E.) |
| ② Sede di Via Necchi, 5/7 | ⑥ Sede di Via Morozzo della Rocca, 2/a | ⑩ Sede di Viale Murillo, 17 |
| ③ Sede di Via Nirone, 15 | ⑦ Sede di Via Suzzani, 279 (Scienze motorie) | ⑪ Sede di Via Lanzone, 29 |
| ④ Sede di Via S. Agnese, 2/4 | ⑧ Sede di P.zza Buonarroti 30, ingresso Via Giotto | |

Building in via Nirone 15

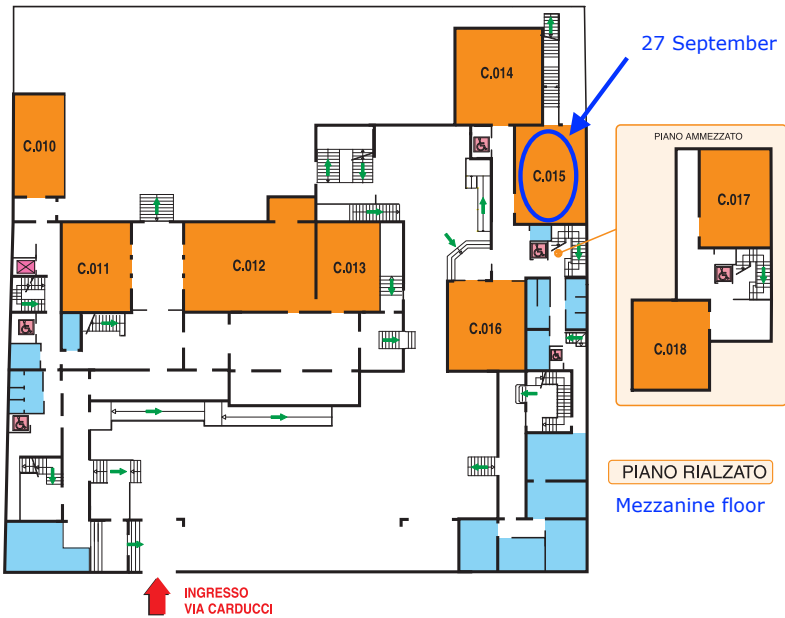
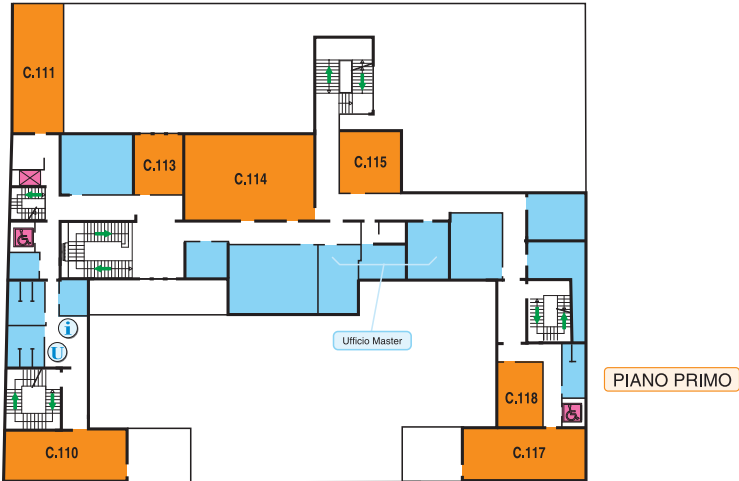
Sede di
Via Nirone, 15



	AULE		UC POINT
	UFFICI E SERVIZI		INFOPOINT
	PASSAGGI E CORTILI		ASCENSORI

Building in via Carducci 28/30

Sede di
Via Carducci, 28/30



Conference Program

Monday, September 24, 2018: room NI.010-011, via Nirone 15

9.30 - 10.30	Welcoming and registration
10.30 - 11.20	Opening lecture: Studia Logica: Past, Present, and Future <i>Jacek Malinowski</i>
11.20 - 12.00	A General Semantics for Hyperintensional Modal Logics <i>Igor Sedlar</i>
12.00 - 12.40	Connexive Logics via Relating Semantics <i>Jacek Malinowski</i>
12.40 - 14.40	Lunch
14.45 - 16.00	Keynote lecture: Rebuilding Epistemic Logic <i>Sergei Artemov</i>
16.00 - 16.20	Coffee break
16.20 - 17.00	Hyperintensional Logic of Responsibility <i>Daniela Glavanicová and Matteo Pascucci</i>
17.00 - 17.40	Why Reconsider Explicit Knowledge? Epistemological Foundations <i>Claudia Fernández-Fernández</i>

Tuesday, September 25, 2018: room NI.111-112, via Nirone 15

9.30 - 10.45	Keynote lecture: Learning Probabilities <i>Soroush Rafiee Rad</i>
10.45 - 11.20	Coffee break
11.20 - 12.00	All-Things-Considered Ought via Reasons in Justification Logic <i>Federico L. G. Faroldi and Tudor Protopopescu</i>
12.00 - 12.40	Pragmatic Logics for Hypotheses <i>Massimiliano Carrara, Daniele Chiffi and Ciro De Florio</i>
12.40 - 14.40	Lunch
14.40 - 15.20	Introducing Causality in Stit Logic <i>Alexandru Baltag, Ilaria Canavotto and Sonja Smets</i>
15.20 - 16.00	Against Individualism: An Impossibility Result <i>Allard Tamminga, Hein Duijf and Frederik Van De Putte</i>
16.00 - 16.20	Coffee break
16.20 - 17.00	A Generalization of Neighborhood Semantics <i>Vit Puncochar and Igor Sedlar</i>
17.00 - 17.40	The Semantics of Negative Trust <i>Giuseppe Primiero</i>
19.30 -	Conference dinner

Wednesday, September 26, 2018: room NI.111-112, via Nirone 15

9.30 - 10.45	Keynote lecture: HYPE: A System of Hyperintensional Logic <i>Hannes Leitgeb</i>
10.45 - 11.20	Coffee break
11.20 - 12.00	Tableaux for Exact Entailment <i>Johannes Korbmacher</i>
12.00 - 12.40	Monadic Situation Semantics for Hyperintensionality <i>Luke Burke</i>
12.40 - 14.40	Lunch
14.40 - 15.20	Simply Fine: The Analytic Way to a Belief Revision Theory <i>Roberto Ciuni</i>
15.20 - 16.00	Truthmaker Semantics for the Logic of Imagination <i>Pierre Saint-Germier</i>
16.00 - 16.20	Coffee break
16.20 - 17.00	Subject Matter: A Modest Proposal <i>Matteo Plebani and Giuseppe Spolaore</i>
17.00 - 17.40	Truthmakers and Objectives <i>Maciej Sendłak</i>

Thursday, September 27, 2018: room C.015, via Carducci 28/30

9.30 - 10.45	Keynote lecture: Completeness of Logic of Information and Common Belief <i>Marta Bilková</i>
10.45 - 11.20	Coffee break
11.20 - 12.00	Non-deterministic Modal Semantics without Possible Worlds <i>Daniel Skurt and Hitoshi Omori</i>
12.00 - 12.40	The Logic of Laboratory Reports <i>Ondrej Majer</i>
12.40 - 14.40	Lunch
14.40 - 15.20	Fine-graining Analytic Impossibilities by Means of Structured Hyperintensions <i>Bjørn Jespersen and Marie Duzi</i>
15.20 - 15.40	Closing address

Invited Lectures

Rebuilding Epistemic Logic

Sergei Artemov

City University of New York

24-09-2018

14:45-16:00

All three foundational pillars on which Epistemic Logic rests: modal language, Kripke-style semantics, and proof theory need modernization.

1. Modal language does not support such central topics in Epistemology as “knowledge vs. justified true belief” discussion initiated by Plato, due to a lack of justification objects. We discuss several paradigmatic epistemic situations which require reasoning with justifications. We argue that Epistemic Logic needs to incorporate properly adjusted Justification Logic.
2. Kripke semantics of possible worlds for epistemic logic is based on a hidden assumption of common knowledge of the model, *CKM*, manifested in the condition “if a sentence is valid at all possible states, then it is known.” Since agents might possess only partial knowledge of possible situations, *CKM* assumption is too restrictive. We introduce epistemic models which do not rely on *CKM*; such epistemic models can be viewed as observable fragments of Kripke models.
3. A well-principled notion of “epistemic theory” as a formal axiomatic description of a given scenario has been conspicuously absent in Epistemic Logic. Moreover, given a verbal description of a situation, a typical epistemic user cherry-picks a “natural model” and regards it as the formalization of the original description. Such a simple-minded approach can formalize only logically complete scenarios whereas some/most epistemic descriptions are incomplete. We introduce ‘frame theories’ for epistemic reasoning with partial information in the possible world environment. Natural semantic counterparts of frame theories are epistemic models from (2), rather than Kripke models.

These are some modernization directions towards the new generation epistemic logic.

Completeness of Logics of Information and Common Belief

Marta Bílková*

Faculty of Arts, Charles University, Prague

27-09-2018

9:30-10:45

To model beliefs of rational agents logically, we switch perspective from a traditional, epistemic alternatives based semantical approach, to information based approach, and see beliefs as based on available information or reasonable expectations. Here the modalities of belief can naturally be seen as diamonds interpreted over information states or probability distributions. In the former case, the corresponding notion of belief is that of confirmed-by-evidence belief. Such epistemic logics have been investigated e.g. as modal extensions of distributive substructural logics [1, 3]. These logical models need to take into account inconsistencies and incompleteness of information, or uncertainty how likely an event is, based on the evidence locally available to agents. This naturally leads us to study in general modal extensions of non-classical logics such as substructural, paraconsistent or many-valued (Belnap-Dunn four valued logic and Lukasiewicz logic especially). As understanding the notion of common belief seems to be crucial to a logical account of group beliefs and their dynamics, one of the aims of this talk is to present common belief extensions of some epistemic logics based on information states semantics, and prove their completeness. We will consider both finitary and infinitary proof theory of those, where common belief is understood as a greatest fixed point expression. To understand the completeness we in particular use two different insights of which we provide theoretical accounts: one coming from abstract algebraic logic, the other from coalgebraic logic.

First, to prove the strong canonical completeness of the innitary versions of the logics we will use a proper version of extension lemmata, such as Lindenbaum or Belnap's pair-extension lemma. We oer a general abstract algebraic perspective at both lemmata for innitary logics, widening the area of their applicability beyond modal extensions of classical logic, and pointing at their limits [2]. Second, understanding the frame semantics of logics we consider as given by coalgebras, and generalizing insights available in at fixed point coalgebraic logics based on classical logic, we prove the completeness of the finitary axiomatization of the logics.

- [1] Bílková, M., O. Majer and M. Peliš. 2016. Epistemic Logics for Sceptical Agents. *Journal of Logic and Computation*, 26(6): 1815–1841. (First published online March 21, 2015.)

*The work has been supported by the project SEGA: From Shared Evidence to Group Agency of Czech Science Foundation and DFG no. 16-07954J

- [2] Bílková, Cintula P., Lávička T. 2018. Lindenbaum and Pair Extension Lemma in Infinitary Logics. *Logic, Language, Information, and Computation. WoLLIC 2018*. Springer.
- [3] Sedlár, I. 2016. Epistemic Extensions of Modal Distributive Substructural Logics. *Journal of Logic and Computation*, 26(6): 1787--1813.

HYPE: A System of Hyperintensional Logic

Hannes Leitgeb

Ludwig Maximilians Universität, Munich

26-09-2018

9:30-10:45

This lecture introduces, studies, and applies a new system of logic which is called “HYPE”. In HYPE, formulas are evaluated at states that may exhibit truth value gaps (partiality) and truth value gluts (overdeterminedness). Simple and natural semantic rules for negation and the conditional operator are formulated based on an incompatibility relation and a partial fusion operation on states. The semantics is worked out in formal and philosophical detail, and sound and complete axiomatizations are provided both for the propositional and the predicate logic of the system. The propositional logic of HYPE can be shown to contain first-degree entailment, to have the Finite Model Property, to be decidable, to have the Disjunction Property, and to extend intuitionistic propositional logic conservatively when intuitionistic negation is defined appropriately by HYPE’s logical connectives. Furthermore, HYPE’s first-order logic is a conservative extension of intuitionistic logic with the Constant Domain Axiom, when intuitionistic negation is again defined appropriately. The system allows for simple model constructions, and its logical structure matches structures well-known from ordinary mathematics, such as from optimization theory, combinatorics, and graph theory. HYPE may also be used as a general logical framework in which different systems of logic can be studied, compared, and combined. In particular, HYPE is found to relate in interesting ways to classical logic and to various systems of relevance and paraconsistent logic, many-valued logic, and truthmaker semantics. On the philosophical side, if used as a logic for theories of type-free truth, HYPE is shown to address semantic paradoxes such as the Liar Paradox by extending non-classical fixed-point interpretations of truth by a conditional as well-behaved as that of intuitionistic logic. Finally, just as classical models may be extended to a possible worlds semantics for modal operators that create intensional contexts, HYPE-models may be extended to a possible states semantics for modal operators that create hyperintensional contexts. In this way, the logic of HYPE may serve as a background logic that applies in the scope of certain hyperintensional operators (e.g., causal operators of the form “ A causes B ”).

- [1] Leitgeb, H. 2018. HYPE: A System of Hyperintensional Logic (with an Application to Semantic Paradoxes). *Journal of Philosophical Logic*. (First online.)

We propose a new model for forming beliefs and learning about unknown probabilities (such as the probability of picking a red marble from a bag with an unknown distribution of colored marbles). The most widespread model for such situations of “radical uncertainty” is in terms of imprecise probabilities, i.e. representing the agent’s knowledge as a set of probability measures. We add to this model a plausibility map, associating to each measure a plausibility number, as a way to go beyond what is known with certainty and represent the agent’s beliefs about probability. There are a number of standard examples: Shannon Entropy, Center of Mass etc. We then consider learning of two types of information: (1) learning by repeated sampling from the unknown distribution (e.g. picking marbles from the bag); and (2) learning higher-order information about the distribution (in the shape of linear inequalities, e.g. we are told there are more red marbles than green marbles). The first changes only the plausibility map (via a “plausibilistic” version of Bayes’ Rule), but leaves the given set of measures unchanged; the second shrinks the set of measures, without changing their plausibility. Beliefs are defined as in Belief Revision Theory, in terms of truth in the most plausible worlds. But our belief change does not comply with standard AGM axioms, since the revision induced by (1) is of a non-AGM type. This is essential, as it allows our agents to learn the true probability: we prove that the beliefs obtained by repeated sampling converge almost surely to the correct belief (in the true probability). We end by sketching the contours of a dynamic doxastic logic for statistical learning.

Contributed Talks

Introducing Causality in Stit Logic

Alexandru Baltag, Ilaria Canavotto, Sonja Smets

In this paper, we propose a refinement of stit semantics in order to make it suitable to represent the causal connection between an agent’s action and its consequences. We do this by supplementing stit semantics, first, with action types and, second, with a relation of opposition between action types. In this way, we obtain a framework in which we can interpret new stit operators suitable to represent basic degrees of responsibility of an agent.

P-HYPE: A Monadic Hyperintensional Situation Semantics

Luke Burke

I extend the semantics of HYPE to the subsentential level. This is achieved by enriching the typed lambda calculus with the reader monad, which indexes the interpretation of terms to situations. This has the following advantages: 1. to show how the semantic values of sentences derive compositionally from the semantic values of their parts, in line with their syntax; 2. Integration: A situation-theoretic account of hyperintensionality adds to the extensive work done in formal linguistics that use monads to model special semantic values without revision of compositional rules and preserving function application as the principal mode of composition. 3. Hyperintensionality as a ‘side effect’: The notion of ‘side effect’ has application to various phenomena; indeed, monads model ‘side-effects’ in programming languages. This suggests a novel understanding of hyperintensionality as a ‘side-effect’ of the ordinary operation of the grammar, with monads capturing possibly incomplete or contradictory situations and preventing the substitution of intensionally equivalent sentences.

Pragmatic Logics for Hypotheses

Massimiliano Carrara, Daniele Chiffi, Ciro De Florio

Speech acts of asserting, denying, hypothesising, conjecturing, doubting that p are pragmatic aspects of language. The basic form $Act(Content)$, where “Act” stands for an act

intended with a certain level of idealisation and “Content” is substituted by a formula of the chosen language. Aim of our talk is to analyse and compare, as two pragmatic approaches to a logic for hypotheses, co-intuitionistic logic and a new logic of hypotheses called *HLP*. *Pros* and *cons* of the two logics for hypotheses will be weighed in the paper. We conclude showing how the richness in the expressive and inferential power of both co-intuitionistic logic and *HLP* can improve the understanding of the nature of hypotheses and, in general, the development of a full pragmatic logic.

Simply Fine: the Analytic way to a Belief Revision Theory

Roberto Ciuni

In a recent paper, Francesco Berto presents a Simple Hyperintensional Belief Revision theory that deploys a fine-grained semantics for doxastic notions and the revision of doxastic attitudes. This semantics is based on (i) a particular kind of Kripke models for doxastic notions such as conditional and unconditional belief, (ii) a “classical” satisfaction relation for the well-formed formulas, and (iii) a content-theoretic apparatus that assigns to each world its content. In this paper, I show that the logic proposed by Berto can be embedded in a suitable epistemic version of the modal and content-sensitive machinery defined by Kit Fine in a paper from 1986, and I discuss the implications of this result for Berto’s framework, its application to formal epistemology and its connections with related logics for belief revision.

An Impossibility Result on Methodological Individualism

Hein Duijf, Allard Tamminga and Frederik Van De Putte

We show that the statement that a group of individual agents performs a deontically admissible group action cannot be expressed in the well-established multi-modal deontic logic of agency that models every conceivable combination of actions, omissions, abilities, obligations, prohibitions, and permissions of finitely many individual agents. This holds true for any group of two or more members. To prove this, we first give a formal definition of this multi-modal logic by specifying its formal language and by giving truth-conditions for the formulas of this language in terms of deontic game models. Secondly, by transforming a given deontic game model into deontic game models that validate exactly the same individualistic formulas as the given model, but give different truth values to collective deontic admissibility formulas, we show that there is no individualistic formula from

this multi-modal logic that is logically equivalent to the statement that a group performs a deontically admissible group action.

All-Things-Considered Ought via Reasons in Justification Logic

Federico Faroldi, Tudor Protopopescu

We give a logical account of all-things-considered (*pro toto*) oughts via practical (*pro tanto*) reasons, adding to the deontic justification logic of (Faroldi and Protopopescu, 2017) a relation of strength on sets of reasons. The agent can reason about reasons and then conclude what ought to be done, all-things-considered, given which reasons are stronger. In the first part of the paper we recall the deontic interpretation of justification logic. In the second part we show how to extend it to all-things-considered-ought. The resulting logic is explicit with regard to pro tanto reasons (which are expressed via terms), implicit with regard to the all-things-considered ought. In the final part of the paper we point out some connections with choice-theoretic ideas.

Why reconsider Explicit Knowledge? Epistemological Foundations

Claudia Fernández-Fernández

In the context of a contemporary interpretation of the knowledge of epistemic agents with limited reasoning abilities, there is a long list of interesting proposals. Still, from the perspective of mainstream epistemology, some of them lack an intuitive correlation to the philosophical views about human knowledge. In order to tend bridges between the new developments of epistemic logic and contemporary epistemological positions, we want to create a theoretical framework (to be extended with the corresponding semantic structure) that captures the conceptual subtleties of epistemic internalism and serves as a foundation for a new formal structure.

Hyperintensional Logic of Responsibility

Daniela Glavaničová, Matteo Pascucci

The logic of responsibility is an emerging field in deontic logic. Some interesting attempts to devise a logic of individual responsibility have been made, but to our knowledge, they all fail to account for some plausible responsibility ascriptions. The aim of our talk will be to philosophically motivate and formally introduce a new logical system for modelling

individual responsibility. Our focus will be on the notion of retrospective individual responsibility understood as culpability or blame. Time and again, we will speak about moral or legal responsibility. While these notions are substantially different, we hold that their logical form is the same; they are just grounded in different normative sources.

Fine-graining Analytic Impossibilities by Means of Structured Hyperintensions

Bjørn Jespersen, Marie Duzi

This paper shows how to, roughly speaking, fine-grain co-intensional analytic impossibilities. We retain the model-theoretic semantics of intensional logic in its classical form, but we superimpose a layer (multiple layers, in fact) of hyperintensions such that we are stacking intensions upon extensions, hyperintensions upon intensions, and higher-order hyperintensions upon lower-order hyperintensions. Our hyperintensions owe their fine granularity to how they are inherently structured. Their structure tracks that of λ -terms. But, importantly, while λ -terms are syntactic objects, our structures are extra-syntactic objects in their own right residing in their own abstract realm. The perhaps greatest challenge for any theory of structured hyperintensions that is informed by (formal) syntactic structure is to avoid excessive fine-graining. We show in this paper how to obtain ‘coarse fine-graining’ basically by privileging certain structures as canonical. This also circumvents the problem that logical structure would be held hostage to syntactic structure.

Tableaux for Exact Entailment

Johannes Korbmacher

I develop tableaux calculi for different propositional logics of exact entailment and prove soundness and completeness.

Connexive Logics via Relating Semantics

Jacek Malinowski

The connexive logic is based on the theses set forth by Aristotle and Boethius, which only use negation and implication connectives. What is more, these theses are contradictory to the classical logic. Therefore, in the connexive logic we must interpret at least one of these connectives in a non-classical manner.

$$(A1) \quad \neg(A \Rightarrow \neg A)$$

$$(A2) \quad \neg(\neg A \Rightarrow A)$$

$$(B1) \quad (A \Rightarrow B) \Rightarrow \neg(A \Rightarrow \neg B)$$

$$(B2) \quad (A \Rightarrow \neg B) \Rightarrow \neg(A \Rightarrow B)$$

There is an idea behind the connexive logic that proposition A has nothing in common with proposition $\neg A$ in terms of the content. Similarly, if A has a common content with B , it cannot have any common content with $\neg B$, and vice versa, if A has a common content with $\neg B$, it cannot have any common content with B . The study offers a new approach to the issue of connexivity. Rather than using for instance the semantics of possible worlds or ternary accessibility relation – as the starting basis for the denition of the connexive logic – we shall assume a certain type of intensional logic: relating logic. By combining the semantic structures for relating logics with a Boolean language we obtain several different logics. The strongest ones among them include Aristotle’s and Boethius’ connexive laws as their tautologies. Hence, they are connexive logics. Further in the study we present the following issues. First, we bring back some basic issues involved in the connexive logics. Further, we present the semantics of the relating logic which we shall uses as grounds for specification of our Boolean connexive logics systems and related issues. By dint of the findings concerning relations between the Aristotle’s and Boethius’ theses and the conditions imposed on the relating relation, we can present a lattice of logics comprising the least Boolean connexive logic along with a natural extension. Lastly, as a decision-making procedure, we propose the tableau methods that we shall elaborate in the last section of the study

The Logic of Laboratory Reports

Ondrej Majer

This paper presents an interpretation of a weak relevant logic built over four-valued relational semantics in terms of the communication of information in a network of laboratories. The knowledge communicated concerns experimental data and the regularities tested using it. We introduce probability in this framework using a weak version of Kolmogorov axioms.

Subject Matter: A Modest Proposal

Matteo Plebani, Giuseppe Spolaore

We present an account of subject matter (SM) inspired by David Lewis' work. Our account shares the attractive features of Lewis' original account, but it has also a number of advantages. In particular, our framework provides a fine-grained account of sentential SM, which is missing from Lewis proposal.

A Generalization of Neighborhood Semantics

Vit Puncchar, Igor Sedlar

In our paper we present a novel semantic framework that can be viewed as a generalization of neighborhood semantics (restricted to monotone models). By this generalization we obtain a fine-grained semantics for a wide range of superintuitionistic modal logics, allowing to vary both the properties of the underlying propositional logic and also of the modalities extending the logic. The basic semantic structures are called information models. In our talk, we will discuss their basic model-theoretic properties concerning such notions as bisimulation and model filtration. We will provide the axiomatisation of the logic of all information models, explore some interesting extensions of this logic and show what classes of information models they correspond to. In particular, we will discuss the case of modal Goedel-Dummett logic.

The Semantics of Negative Trust

Giuseppe Primiero

The logical representation of agency has received a strong impulse by the development of semantics for epistemic modalities, since the seminal work of Hintikka and up to the recent developments in dynamic epistemic logics. In these modern trends in logic, the focus is on crucial operations like those of belief and update. Another important concept, that of trust, is less ubiquitous in formal logic. Trust defines several epistemic processes in which agents are not able or willing to acquire knowledge directly, and prefer or are required to rely on assumptions or epistemically weaker conditions, like in the case of testimony. In this work we first overview the current results of the proof-theoretic semantics of trust defined by the language SecureND. In this system, trust is defined as a modal-style function which works as an agent's profile consistency check operation on incoming new information. The model is specifically designed for resource access control scenarios and

to be able to block trust transitivity by design. (un)SecureND is an extension obtained through the introduction of separate protocols to deal with failing consistency. Next, we present the first attempt at a possible-world semantics sound with respect to the proof theory of (un)SecureND.

Truthmaker Semantics for the Logic of Imagination

Pierre Saint-Germier

Franz Berto has proposed a conditional logic of imagination which deals with hyperintensionality with the help of a mereology of topics. I propose an alternative truthmaker semantics for the same language, which preserves all the important validities, but avoid problematic ones. In particular, the truthmaker semantics, which can be independently motivated on philosophical grounds, allows to draw more fine grained hyperintensional distinctions, which are independently desirable.

A General Semantics for Hyperintensional Modal Logics

Igor Sedlar

The paper presents a hyperintensional generalization of the neighborhood semantics for modal logic. In our semantics, neighborhoods are not sets of propositions, but sets of ‘contents’, objects that are considered primitive in our framework. The standard interpretation function (from formulas to propositions) is the composition of two functions in our models, namely, a ‘content’ function assigning contents to formulas and a ‘proposition’ function, assigning propositions to contents. The latter function is not assumed to be one-to-one, thus allowing for a hyperintensional, fine-grained representation of content. It is shown that the main approaches to hyperintensional modality (that is, syntactic approaches, approaches based on non-normal worlds and approaches invoking structured propositions) are all special cases of our framework that correspond to models using special sets of semantic contents. We define and study logics based on our general framework. The main technical result is a completeness proof for an axiomatization of a hyperintensional modal logic with a connective expressing identity of content.

Truthmakers and Objectives

Maciej Sendłak

The aim of my paper is to propose an alternative interpretation of the notion of truth-making. One which would deliver a fine-grained picture of this notion and eventually lead to the rejection of the *Principle of Entailment*. This proposal is based on the notion of impossible worlds and on Alexius Meinong's concept of objectives, i.e., ontological correlates of propositions, of which some do subsist and some do not.

Non-deterministic Modal Semantics without Possible Worlds

Daniel Skurt, Hitoshi Omori

We will present non-deterministic hierarchical semantics for the normal modal logics K , KD , KTB . Furthermore, we will address some problematic aspects of the presented semantics, namely, primitive vs. defined connectives, and analyticity.