

## Logic & Philosophy of Science in Belgium – Abstracts

Diderik Batens (Universiteit Gent)

*The Plot behind Adaptive Logics and its Relations to the Research at the Ghent Centre*

Friday 14.15-15.15h

The adaptive logic programme aims at developing a type of formal logics (and the connected metatheory) that is especially suited to explicate the many interesting dynamic consequence relations that occur in human reasoning but for which there is no positive test. Such consequence relations occur, for example, in inductive reasoning, handling inconsistent data,...

The explication of such consequence relations is realized by the dynamic proof theories of adaptive logics. These proof theories are dynamic in that formulas derived at some stage may not be derived at a later stage, and vice versa.

The programme is application driven. The main applications are taken from the philosophy of science, some also from more pedestrian contexts. The interest in dynamic consequence relations led rather naturally to an interest in dynamic aspects of reasoning. Some of these already occur in Classical Logic.

In this lecture, I shall summarize the central mechanisms (including some variants) from a proof theoretic as well as from a semantic point of view, and I shall discuss some application contexts (especially from the philosophy of science).

Federica Russo (Université Catholique de Louvain)

*From Probabilistic Theories of Causality to Causal Modelling: Bringing Causal Theory to Maturity*

Friday 15.30-16.15h

No doubt probabilistic theories of causality advanced by I.J Good and P. Suppes are a significant step in providing a better analysis of causal relations. A number of criticism have been raised against these probabilistic approaches, and many of them are indeed sound. Nonetheless, probabilistic theories are right in their basic idea, namely in advocating a

*probabilistic* analysis of causal relations. In spite of this, probabilistic theories still are an unsophisticated tool to establish causal relationships. As Suppes puts it, it is important to bring any causal theory to maturity by showing how it relates to detailed statistical theory and practice. Hence, I will take up this challenge. In undertaking this path I will explain what causal models are and show their advantages for causal analysis. In particular, I will argue that these models allow to account for the multivariate aspect of causality, to make all the assumptions needed to draw causal conclusions explicit, and mostly that they give room for a promising *rationale* of causality.

Kathleen Coessens (Vrije Universiteit Brussel)

*Cartographic Paradoxes and their Relevance for Information and Knowledge*

*Domains*

Friday 16.15-17.00h

Cartography, the compilation of the spatial world, has, like other sciences, been affected by critique that results in five paradoxes. Mapping (1) is subject to reduction though surpassing all perceptual and cognitive means, (2) and to redundancy while being fragmentary; (3) it shows reality in a virtual mode and (4) loses itself in an ongoing *mise-en-abîme*. These four paradoxes culminate in (5) a Magritte-paradox: is this the world or is this only a map of the world. This lecture will analyse the relevance of these five paradoxes of cartography for other fields of information and knowledge. It will bring together different critiques on science. The conclusion will be that, as a metaphor, as a method, and as a scientific endeavour, cartography can help to distinguish some of the pitfalls of scientific research in general, while at the same time offering new possibilities for representing and compiling knowledge information.

Roland Hinnion (Université Libre de Bruxelles)

*Russell's Paradox: a Source of Inspiration for more than 100 Years*

Friday 18.00-19.00h

Classical set theory (in the style of Zermelo-Fraenkel) satisfies fully most mathematicians; but in other domains (computer science, artificial intelligence, situation theory, philosophy, linguistics,...), and in particular mathematical fields (category theory, non-standard analysis,...), less usual set theories can appear as more useful; be it special extensions of ZF

(via Antifoundation axioms, or large cardinal assumptions, etc...), or more "exotic" systems that modify (respectively, and more profoundly):

\* the comprehension rules (examples: Quine's New Foundations; Positive Set Theories))

\*the notion itself of "extension of a set" (examples: Double Set Theories; Partial Sets; Paradoxical Sets)

\*the underlying logic (examples: Naive Set Theory in Non-classical Logics (paraconsistent/paracomplete/multivalued/...))

These "exotic" systems are at present known under the "generic name" (due to Randall HOLMES) : "Set Theory with a Universal Set"; the corresponding bibliography is astonishingly rich, as well for the number of publications, as for the quality and diversity of concerned domains; another surprising fact is that this is always more or less linked to the (very simple, but incredibly dangerous) paradox of Russell, and has been a subject of study for more than 100 years (often by "great names"). It is impossible to discuss, or even give a survey, of the concerned aspects of this line of research; at least in a normal talk; so I will only discuss (without exhaustivity) the partial set theories: the known results, the conjectures, the open problems, the links with "partial information", the links with "paradoxical set theory".

Jean Paul Van Bendegem (Vrije Universiteit Brussel)

*The Richness and Inspiration of (the philosophy of) Mathematics*

Saturday 10.00-11.00h

The research at the Centre for Logic and Philosophy of Science at the Vrije Universiteit Brussel mainly concerns the many facets of mathematics: the understanding of the internal dynamics of the mathematical development, the biological basis of mathematical abilities, sociological critique inspired by sociologists like Sal Restivo. The main goal is to eventually arrive at a description, as complete as possible, of the full richness of the mathematical practice. Linked with this core research are more logically oriented themes like quantum logic and the couple logic-information; but also more natural language and anthropological oriented research.

[Het onderzoek dat plaatsheeft in het Centrum voor Logica en Wetenschapsfilosofie (CLWF) aan de Vrije Universiteit Brussel draait in eerste instantie rond de vele facetten van de wiskunde, gaande van het begrijpen van de interne dynamiek van de wiskundige ontwikkeling over de biologische basis van wiskundige vermogens tot een sociologische kritiek, geïnspireerd door sociologen zoals Sal Restivo. Het hoofddoel is uiteindelijk een zo volledig mogelijke beschrijving te kunnen bekomen van de wiskundige praktijk in haar volle rijkdom. Rond dit kernonderzoek situeren zich meer naar de logica georiënteerde thema's zoals kwantumlogica en het koppel logica-informatie, maar evenzeer meer naar de natuurlijke taal en antropologisch georiënteerd onderzoek]

Thomas Brihaye (Université de Mons-Hainaut)

*Model-Checking, Logic and Decidability*

Saturday 11.30-12.15h

More and more real-life systems are automatically controlled. It is of a capital importance to know whether the programs governing these systems are correct. In other words, given a real-life system (e.g. a power plant), given a specification (e.g. the temperature of the reactor is less than some constant  $K$ ), we would like to know if the system verify the specification. The first step to answer this question is to abstract the real-life system into a mathematical model (e.g. automata) and to abstract the specification into a logic formula. The second step is to answer automatically to the question: "Does the abstract mathematical model verify the logic formula?". This second step is called Model-Checking. In this talk we will be interested in the links between Model-Checking and Logic. It is well-known that the theory of automata is a powerful tool to prove the decidability of theories (e.g. Presburger Arithmetic). Recently it seems that the power of logic is used in order to give decidability results on Model-Checking Problems. This is the case for the o-minimal hybrid systems. This class of systems with good finiteness properties leads to some decidability results but also to disturbing open questions...

Leen De Vreese (Universiteit Gent)

*How a Pluralistic View Can Draw a Realistic Picture of Causation*

Saturday 12.15-13.00h

In my talk I will try to demonstrate how too narrow a perspective on the topic of causation leads a lot of philosophers (s)till today to a search of the one and only and final theory of causation while being adverse towards alternative approaches. I try to show that this way of working brings us no further. We need to broaden our scope to get rid of our monolithic view on causal relations. An important pioneer in this way of reasoning about causation is Christopher Hitchcock, who states that there does not exist something like *the* causal relation [1]. Depending on the context we will pay attention to one or another of different kinds of causal relations. I agree it is very important to be aware of the context-dependency of causation, leading to a pluralism of causal relations. However, when looking for a general approach to the analysis of the concept of "cause" in scientific reasoning, a difficulty seems to

appear. Reasoning from the context-dependency of causation will give us a methodology that is too fragmented, too particularistic. It is after all impossible to investigate every cause-effect chain separately within the own appropriate context. Hence, we need to look for a feasible approach that stands midway between a too monolithic and a too particularistic view on the concept of cause in science. I will argue that this midway can be found in starting to reason from domains of application when developing our theories of causation.

[1] Christopher R. Hitchcock, Of Humean Bondage, *British Journal for the Philosophy of Science*, vol. 54, p. 1-25, 2003.

Michel Ghins (Université Catholique de Louvain) <i>Models and Realism in the Natural and Social Sciences</i> Saturday 15.00-16.00h
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Liza Verhoeven (Universiteit Gent) <i>The Relevance of a Relevantly Assertable Disjunction for Material Implication</i> Saturday 16.30-17.15h
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According to Grice the divergences in meaning between the logical connectives and their counterparts in natural language are only apparent. In his opinion the differences are bridged by focussing on the feature of assertability. If he was on the right track, the apparent divergences should disappear as soon as the feature of assertability is incorporated in the logic. I impose (part of) Grice's requirements for assertability on the disjunction of Classical Logic, which results in a new logic, RAD. In this logic a disjunction is a consequence of the premises if and only if it is a consequence of the premises by Classical Logic and it is relevantly assertable in view of the premises, i.e. it is a shortest disjunction. (As a consequence Addition is no longer a valid inference rule.) The material implication that is defined in terms of negation and this relevantly assertable disjunction, has been freed of most of its paradoxes.

The RAD consequence relation bears a very strong resemblance to the relevant-conclusion consequence relation of Schurz. A logic C in between, that, in contrast with RAD, does not give any consequences for inconsistent premise sets, indicates that the irrelevance of classical

disjunction is rooted at the more fundamental level of the definition of semantical consequence relation.

Koen Vermeir (Katholieke Universiteit Leuven)

*The Resurrection of the Demarcation Problem*

Saturday 17.15-18.00h

In this paper, I argue that the demarcation problem is as topical as it ever was. It is not a pseudo-problem as Laudan contended, but issues of scientific validity, the status of science, the relevance of science, science's ontology and the role of science in society are at stake. After sketching the history and the state of the art of the demarcation problem, I analyse Laudan's arguments for proclaiming its demise and find them wanting. In fact, Laudan constructed the problem in such a way that there could not possibly be a solution. As a result of my analysis, it becomes clear that one can proceed either by making a clear distinction between normative and descriptive perspectives or by integrating 'rational' and 'social' factors. I will argue that, instead of leaving the issue to scientists and debunkers, the demarcation problem can gain prominence in philosophy again by admitting that social factors play an important role in epistemology.