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INTRODUCTION

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According to the members of the Wiener Kreis, there was a strong connection between logic, reasoning, and rationality. They believed that human reasoning (and in particular scientific reasoning) is rational in so far as it is based on logic (which meant for them Classical Logic). It was also believed that scientific reasoning (for them the hallmark of human reasoning) was in general rational. In the second half of the twentieth century, both beliefs came under attack.

One of the motors for this change was the turn in history of science, that was initiated by Alexandre Koyré. In the 'old history of science' success stories were told, usually on the basis of published papers and even textbooks, and only theories that had survived were considered (Galileo's law of free fall, Kepler's three laws, Newton's gravitation theory, ...). Moreover, no attention was paid to mistaken paths, nor to the contexts in which the original theories were formulated and accepted. So, what happened was that nice and polished reconstructions were made, with Classical Logic as the underlying logic, and that the results were deemed to be rational. In the 'new history of science', things changed radically. Theories were studied in their historical setting, and explicit attention was directed not only to theories that were abandoned (such as the phlogiston theory), but also to flaws, and to elements that played a crucial role in the construction of new theories, but that are today considered as non-rational — examples are Kepler's work on astrology and on the harmony of the spheres, and Newton's work on alchemy.

In the aftermath of Koyré, philosophers of science, such as Hanson and Kuhn, also followed this new trend and started basing their philosophical analysis on actual examples from the history of science. Two central lessons came out of all this. First, the so-called 'context of justification', which was the sole concern of the members of the Wiener Kreis, is less straightforward and less 'logical' than was traditionally accepted. Next, the 'context of discovery' is much more structured and methodical than was believed within the Wiener Kreis, even though it is not understandable from the point of view of Classical Logic. The conclusion was that logic is inadequate to explicate actual examples of human reasoning, whether in the sciences or in everyday life.

There were several reactions to this situation. Some scholars held on to the link between (classical) logic and rationality, but concluded that scientific reasoning (especially as it occurs in the context of discovery) is inherently non-rational or even irrational. Others gave up the connection between logic and rationality. They looked for tools elsewhere (mainly in psychology and cognitive science) to analyse the rational character of scientific reasoning, often at the expense of rigour and formal accuracy. Times have changed, however. Today, a multiplicity of formal frameworks (ranging from non-classical logics over probability theory to Bayesian networks) is available in addition to Classical Logic. Also, historians and philosophers of science as well as psychologists have described a rich variety of patterns in both scientific and common sense reasoning.

The aim of the congress *Logic, Reasoning and Rationality* (Centre for Logic and Philosophy of Science, Gent, 20–22 September 2010) was to stimulate the use of formal frameworks to explicate concrete examples of human reasoning, and conversely, to challenge scholars in formal studies by presenting them with interesting new examples of actual reasoning. This special issue contains a selection of the more formal papers presented at the congress. Other papers presented at the congress will be published in a book (*Logic, Reasoning and Rationality*, Springer) and in special issues of the journals *Foundations of Science*, *Logic & Logical Philosophy* and *Philosophica*.

In *Transparent Quantification into Hyperpropositional Contexts de re* Marie Duží and Bjørn Jespersen provide two logical rules for transparent quantification into hyperpropositional contexts *de re*. One rule validates this inference: Mary believes of the Evening Star that it is a planet; therefore, there is an x such that Mary believes of x that it is a planet. The other rule validates this inference: the Evening Star is such that it is believed by Mary to be a planet; therefore, there is an x such that x is believed by Mary to be a planet.

The article *Tense and Temporal Reference. Hybrid Temporal Logic* by María Ponte and Margerita Vázquez is about the work of Arthur Prior. His approach to time has been neglected by semanticists for several reasons. According to Ponte and Vázquez, foremost among these reasons is the inability of Priorean tense logic to refer to times. Second is its inability to account for some important features of natural language such as temporal anaphora and the role of temporal constructions in discourse. Priorean tense logic has, however, one important advantage over other accounts: the internal perspective of time (due to its modal nature). Their paper examines extensions of Priorean tense logic in which reference to times is possible, focusing on the so-called hybrid temporal logic. Ponte and Vázquez line out some of its main features and analyse some of its philosophical implications.

In *Contextual Type Theory with Judgemental Modalities for Reasoning from Open Assumptions*, Giuseppe Primiero explores the application of contextual type theories for knowledge representation purposes. In his view, the combination of a constructive language with a modal extension of contexts is crucial to exploring the attractive idea of a type-theoretical calculus of provability from refutable assumptions for non-monotonic reasoning. His paper introduces such a language: the modal operators are meant to internalize two different modes of correctness, respectively with necessity as the standard notion of constructive verification and possibility as provability up to refutation of contextual conditions.

The paper *Extending the Standard Format of Adaptive Logics to the Prioritized Case* by Frederik Van De Putte and Christian Straßer introduces a new format for reasoning with prioritized standards of normality. The format is applicable in a broad variety of contexts, e.g. dealing with (possibly conflicting) prioritized belief bases or combining different reasoning methods in a prioritized way. The format is a generalization of the standard format of adaptive logics. Every logic that is formulated within it has a straightforward semantics in the style of Shoham's selection semantics and a dynamic proof theory.

In *A Calculus for Belnap's Logic in Which Each Proof Consists of Two Trees*, Stefan Wintein and Reinhard Muskens introduce a Gentzen calculus for a functionally complete variant of Belnap's logic in which establishing the provability of a sequent in general requires two proof trees, one establishing that whenever all premises are true some conclusion is true and one that guarantees the falsity of at least one premise if all conclusions are false. The calculus can also be put to use in proving that one statement necessarily approximates another, where necessary approximation is a natural dual of entailment. The calculus, and its tableau variant, not only captures the classical connectives, but also the 'information' connectives of four-valued Belnap logics.

The congress was organised in honour of Diderik Batens. It served as an opportunity for him — at the verge of his retirement — to look back on his long and distinguished academic career and clarify to the audience his personal views. Among other things, Batens helped shape paraconsistent logic and was the founder of adaptive logics.

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