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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

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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 papers presented at the congress in which non-classical logics are applied to problems in epistemology and philosophy of science. Other papers presented at the congress will be published in a book (*Logic, Reasoning and Rationality*, Springer) and in special issues of the journals *Logic & Logical Philosophy, Logique & Analyse* and *Philosophica*.

In *Contemporary Epistemic Logic and the Lockean Thesis* Lorenz Demey shows us the fruitful results of treating the Lockean thesis from the perspective of contemporary epistemic logic. The Lockean thesis states that belief can be defined as 'sufficiently high degree of belief'. Its main problem is that it gives rise to a notion of belief which is not closed under conjunction. This problem is typical for *classical* epistemic logic, which is single-agent and static. Lorenz Demey argues that from the perspective of *contemporary* epistemic logic, the Lockean thesis fares much better.

Scientists confronted with multiple explanatory hypotheses as a result of their abductive inferences generally want to reason further on the different hypotheses one by one. In *Modelling Abduction in Science by means of a Modal Adaptive Logic* Tjerk Gauderis presents a modal adaptive logic that enables us to model abduction in such a way that the different explanatory hypotheses can be derived individually. This modeling is illustrated with a case study on the different hypotheses on the origin of the Moon.

In *The Unexpected Applicability of Paraconsistent Logic: A Chomskyan Route to Dialetheism* Nicholas D. McGinnis develops a 'naturalized semantic dialetheism' following Graham Priest's early suggestion that the principles governing human natural language may well be inconsistent. There is a significant deviation from Priest's work, namely, the assumption of a broadly Chomskyan picture of semantics. This allows us to explain natural language inconsistency tolerance without commitment to contentious views in formal logic.

Rafal Urbaniak and Frederik Van De Putte argue in their paper *Induction from a Single Instance: Incomplete Frames* that dynamic frame theory—although not developed with that purpose in mind—allows for the precise formulation of a number of problems associated with induction from a single instance. A key role is played by the distinction between complete and incomplete dynamic frames, for incomplete frames are elegant candidates for the format

of the background knowledge used in induction from a single instance. Furthermore, they show how dynamic frame theory provides the terminology to discuss the justification and the fallibility of incomplete frames.

In *Non-monotonic set theory as a pragmatic foundation of mathematics* Peter Verdée proposes a new approach to the foundation of mathematics: non-monotonic set theory. He presents two completely different methods to develop set theories based on adaptive logics. For both theories there is a finitistic non-triviality proof and both theories contain (a subtle version of) the comprehension axiom schema. The theories have enough expressive power to form a justification/explication for most of the established results of classical mathematics. They are therefore not limited by Gödel's incompleteness theorems.

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.