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EDITORIAL NOTE

The contributors to this volume share two fundamental convictions. The first is that beliefs and practices of individuals and small research groups play a crucial role in scientific change. Innovative results are not produced by abstract minds that apply some General Scientific Method to the set of commonly shared beliefs and practices. They are forged by concrete individuals and groups on the basis of their beliefs and practices. Some of the latter may not (yet) belong to the general knowledge system and in many cases even conflict with it. The second conviction is that, even if the role of the specific beliefs of individuals and groups is recognized, scientific change can be seen as rational. The combination of these claims may come for some readers as a surprise. Even in contemporary sciences studies, the combination of both claims is far from evident.

From the seventeenth century until very recently, all models of scientific change were characterized by a trade-off between viewing scientific change as rational and recognizing the role of creativity. According to the 'classical model' prevailing in the seventeenth and eighteenth centuries, science proceeds in a continuous way and by the mere application of The Scientific Method. This model pretends to guarantee rationality, but leaves no room for creativity. In its extreme form, the 'romantic model', a typical product of the nineteenth century, leads to the opposite result. Its adherents recognize creativity as essential for scientific change, but attribute creative products to sudden flashes of insight, to luck, or to other non-rational mechanisms. The romantic model continued to dominate most of the twentieth century.

Although it is commonly accepted that the conventionalists (Mach, Duhem, Poincaré) and later the logical empiricists were advocates of the romantic model, their view on creativity and its relations to rationality and scientific change is actually much more subtle. As is shown in Meheus 199+, the conventionalists as well as the logical empiricists accepted that most if not all creative processes are complex and highly

structured search processes. In line with this, they accepted that 'methods of discovery' can and should be developed. Some of them even actively engaged in the design of such methods. At the same time, however, they were convinced that creative processes are necessarily dependent on 'interpretations' which are not themselves the outcome of a rational process. In addition to this, they disconnected the rationality of science from the way in which new results are obtained, and located it solely with the way in which those results are justified and accepted. For *these* reasons, they viewed creative processes as non-rational.

In a sense, Kuhn tried to reconcile both models. While the classical model enables us to understand 'normal science' (researchers solve puzzles in a rational but non-creative way), 'revolutionary science' is interpreted in terms of the romantic model. As the latter is essential for the direction in which a discipline evolves, Kuhn seems unable to escape the conclusion that, ultimately, scientific change is irrational.

The two kinds of reactions to Kuhn's work may be seen as stands with respect to the two models. One way to describe Feyerabend's position is to see it as a plea for more room for creativity. Feyerabend extends the scope of the romantic model so as to cover *both* the then popular contexts: the context of discovery and the context of justification. Others, like Laudan, reacted against the irrationalism in Kuhn's position. It is remarkable, however, that rationality is restored to a very large degree at the expense of creativity. One of the central pillars of Laudan's model is that individual researchers, in a given historical period but irrespective of their 'personal' beliefs, should always agree on (i) the question whether a given problem is solved, and (ii) the weight that should be assigned to that problem. As is shown by de Regt in this volume, both assumptions are highly problematic in creative science.

One of the very first attempts to reconcile creativity and rationality was provided by Thomas Nickles (see especially his 1980, 1981 and 1985). Even if not all contributors to the present volume consider Nickles' model as unobjectionable, it is no coincidence that they all are, in one way or other, influenced by it. I now briefly review the papers of the present volume. They include systematic contributions as well as detailed cases studies.

Thomas Nickles provides an extensive overview of the evolution of methodological views, concentrating on attitudes with respect to cognitive variation. He defends an account of rationality that allows for cognitive

variation and in which a central role is assigned to heuristic appraisal and cognitive economy, two mechanisms that are traditionally seen as irrelevant to rationality.

An interesting case study of Goldschmidt's attack on neo-Darwinism is presented by Scott Kleiner. Although the ontogenetic evolutionary theory is clearly heretic, it turns out, in view of Goldschmidt's convictions, to be a rational response to problems that actually affected neo-Darwinism. The study shows the way in which dissident ideas may be both rational with respect to a researcher's beliefs and useful for the disciplinary community.

A general abductive model for scientific change is proposed by David Gooding. The model allows one to analyze structural properties of concrete discovery processes in such a way that their rational character emerges. Nevertheless, it is sufficiently flexible to account for creative insights and reinterpretations. The strength of the model is illustrated by means of three examples deriving from very different domains.

Tassos Tsiadoulas offers an extensive case study of Van der Waals' discovery of the ψ-surface. This discovery process involved a number of steps that appear unjustified (and were actually considered as on the wrong track by contemporaries). By referring to Van der Waals' specific constrains for the problem, Tsiadoulas demonstrates that those steps were not only justifiable, but in fact were the only justifiable ones.

Relying on two examples from the history of physics, Henk de Regt argues that individual philosophical beliefs may play a decisive role in the assessment of novel results. He demonstrates that the models of Kuhn, Lakatos, and Laudan are incapable of accounting for this phenomenon. He then defends a model for scientific change that does not only leave room for paradigmatic differences, but also for individual variation within paradigms.

In the final paper, Diderik Batens and Joke Meheus consider five challenges that any problem solving model should meet in order to provide a methodological approach to scientific creativity. After criticizing Nickles' constraint-inclusion model, they demonstrate that their contextual model is able to meet the challenges in a natural and realistic way.

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