PREFACE

Within traditional philosophy of science, the role of inconsistencies has largely been ignored. At best, inconsistencies were seen as a hindrance for good scientific reasoning. The reason for this is not difficult to understand. Until very recently, rationality has been identified with reasoning according to Classical Logic. And, as is well known, Classical Logic does not allow one to reason sensibly in the presence of inconsistencies.

Today, it is generally recognised that almost all scientific theories at some point in their development were either internally inconsistent or incompatible with other accepted findings (empirical or theoretical). A growing number of scholars moreover recognises that inconsistencies need not be disastrous for good reasoning.

Three developments were central for this change in attitude. First, there is the shift in attention from finished products to discovery processes. Whereas finished theories usually seem to satisfy the consistency requirement, developing theories typically do not. Next, there is the availability of case studies on episodes in the history of the sciences that involved inconsistencies. Finally, there is the study of paraconsistent logics[1] that started some fifty years ago. This study not only challenged the view that Classical Logic would be the appropriate tool for reasoning in all contexts, but also resulted in a variety of systems that are adequate for reasoning in inconsistent contexts.

The prevalence of inconsistencies in the sciences raises a large number of interesting questions. How should 'logical anarchy' be avoided? Should one resort to a paraconsistent logic or to non-logical criteria? What about the acceptance of inconsistent theories? Are we ever justified to accept an inconsistent theory, and if so, can this acceptance be more than provisional? How does inconsistency affect our notion of truth? Should inconsistent theories at best be considered as 'containing some truth' or can they be considered as true in the same strong sense as consistent theories? Do inconsistencies exist in the world out there or only in the theories we

[1] A logic is called paraconsistent iff it does not validate *Ex Falso Quodlibet* ($A, \sim A \vdash B$).

humans design about that world? The obvious importance of these questions certainly warrants to devote a series of studies to the theme.

The incentive for this book was the *First World Congress on Paraconsistency* (Ghent University, Belgium, 30 July – 2 August 1997). At this congress, a workshop on *The Role of Inconsistencies in the History and Philosophy of Science* was organized. This was not the first meeting devoted to the theme. However, the Ghent workshop was at least for two reasons unique. Never before had a meeting on this subject been attended by specialists from all over the world. And even more importantly, never before had philosophers of science and historians of science met with logicians and computer scientists to discuss this intriguing theme. A selection of papers presented at this workshop is included in the present volume. In order to do justice to the variety of approaches, this selection has been extended with a number of invited papers.

The book opens with two contributions from the philosophy of science, "From Copernicus to Ptolemy: Inconsistency and Method" by Thomas Nickles and "Inconsistent Reasoning toward Consistent Theories" by Arthur Miller. Nickles compares the standard theory-centred conception of science with newer pragmatic and model-based accounts of scientific inquiry regarding their methodological treatment of inconsistencies. Miller investigates different sources of inconsistencies, and draws some conclusions from this with respect to scientific progress. These are followed by two studies in the philosophy of mathematics, "Inconsistencies in the history of mathematics: the case of infinitesimals" by Jean Paul Van Bendegem and "Mathematical Change and Inconsistency: A Partial Structures Approach" by Otávio Bueno. Van Bendegem explores an alternative approach for limit analysis that solves the inconsistencies connected with infinitesimals; the case is further used to defend a contingent view on mathematical progress. Starting from da Costa's and French's partial structures approach, Bueno presents a framework for mathematical change that assigns a positive role to inconsistencies. He applies the framework to the development of set theory.

Next, there are several analyses of inconsistencies in the empirical sciences that are based on a specific paraconsistent approach, "Approximate Truth: A Paraconsistent Account" by Bryson Brown, "Inconsistency in Science: A Partial Perspective" by Newton da Costa and Steven French, "Inconsistency and the Empirical Sciences" by Graham Priest, "In Defence of a Programme for Handling Inconsistencies" by Diderik Batens, "How to Reason Sensibly yet Naturally from Inconsistencies" by Joke Meheus and "Why the Logic of Explanation is Inconsistency-adaptive" by Erik Weber and Kristof De Clercq. The first three of these defend each a different realistic view on inconsistent theories. Brown presents an account of approximate truth that is based on a specific non-adjunctive approach to paraconsistency, and that aims at explaining the success of past and current (possibly inconsistent) theories. da Costa and French offer a model-theoretic account in which theories are regarded as partial structures. On this account, inconsistent theories (just like consistent ones) can be considered as partially true and accepted as such. Priest advocates the view that reality itself is inconsistent and that contradictions are observable. In line with this, he defends the idea that inconsistent theories can be considered as true in the strong sense of the word. The last three papers in this group explore the philosophical foundations and some applications of inconsistency-adaptive logics. Batens spells out the philosophical programme underlying this family of logics; one of his central arguments is that handling inconsistent theories requires a logic that stays as close as possible to Classical Logic. Meheus argues that reasoning from inconsistencies requires an extremely rich inconsistency-adaptive logic, and presents a system that meets this requirement. Weber and De Clercq argue that inconsistency-adaptive logics are much better suited than Classical Logic to define the different types of explanation.

The volume closes with two case studies, "A Paradox in Newtonian Gravitation theory II" by John Norton and "Inconsistency, Generic Modeling, and Conceptual Change in Science" by Nancy Nersessian. Norton provides a rigorous yet transparent demonstration of the inconsistency of Newtonian Cosmology, and defends the view that physical theorists handled this inconsistency by a content driven approach rather than a logic driven approach. Nersessian analyses Maxwell's construction of the laws of electrodynamics, and shows how generic modeling enabled him to tolerate several inconsistencies in his derivation.

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