

Preface

This book grew out of a colloquium initiated by Wolfgang Lefèvre and Peter Damerow in Berlin many years ago. In this colloquium we attempted over a number of years to acquire an understanding of cognitive development in science that takes account of a number of factors usually considered in isolation: the cumulative or progressive aspects of science, its embedding in culture and society, the cognitive content of theories, and the relationship of science to contemporary philosophical systems. The results of our discussions are embodied in a number of books and other publications by various members of the colloquium – some programmatic in nature, some case studies of particular scientific developments. Among the way stations are: Wolfgang Lefèvre, *Naturtheorie und Produktionsweise* (Darmstadt: Luchterhand, 1978), *Die Entstehung der biologischen Evolutionstheorie* (Berlin: Ullstein 1984); Peter Damerow and Wolfgang Lefèvre, *Rechenstein, Experiment, Sprache* (Stuttgart: Klett-Cotta 1981); Gideon Freudenthal, *Atom and Individual in the Age of Newton* (Dordrecht: Reidel 1986); Peter McLaughlin, *Kant's Critique of Teleology in Biological Explanation* (Lampeter: Mellen 1990); a number of papers on Galileo by Jürgen Renn (see Bibliography) as well as his contributions as an editor of the *Collected Papers of Albert Einstein* (Princeton Univ. Press, 1987, 1989, 1992); and finally the numerous papers on cognitive development by Peter Damerow published mainly in German, a selection of which is to appear in English under the title, *The Cultural Conditions of Thinking*, as a volume of *Boston Studies in the Philosophy of Science* in the near future.

In the present volume we attempt to display some aspects of the cognitive development involved in the emergence of modern science. We study this development in a detailed analysis of three interrelated examples at the core of early theories of motion.

The book as a whole is both in its approach and in many of its individual findings a genuinely collective product and reflects a common understanding established in many years of close cooperation. Our study of early modern mechanics at first followed some preliminary theses introduced by Freudenthal but soon took on a life of its own and superseded our initial conceptions. The Introduction and Epilogue were written jointly, and all other parts, while written by individuals, have been scrutinized and criticized by the others in the group. Damerow and Freudenthal wrote Chapter 1; Freudenthal and McLaughlin wrote Chapter 2; Renn wrote Chapter 3. On McLaughlin fell the task of editing, sometimes heavily, each of the individual chapters in order to free shared ideas from idiosyncratic presentations.

The translations in the text and in the Documents Chapter have a checkered history and unclear parenthood: some were originally produced by Freudenthal as working translations for our internal discussions; translations from the Italian are

by Renn; others were first drafted by McLaughlin, with whom final responsibility for all French and Latin translations lies. As the only native speaker of English in the group, McLaughlin is also responsible for all grammatical errors, Germanisms and stylistic solecisms that remain in the text as a whole.

Since our Berlin days the four authors have been dispersed to four different cities on three different continents. Our continuing work would not have been possible without the generous support of a number of institutions. The home base and main stay of the project has always been Damerow's office in the Center for Development and Socialization at the Max Planck Institute for Human Development and Education in Berlin. We would especially like to thank Director Wolfgang Edelstein for constant encouragement and a kind of support of our long-term interdisciplinary project going beyond academic hospitality. We would also like to thank Yehuda Elkana of the Van Leer Jerusalem Institute, and Jürgen Mittelstrass of the Center for Philosophy and Philosophy of Science at the University of Constance whose support over the years have made our co-operative venture feasible. Furthermore, we are grateful to the Fritz-Thyssen Foundation (Cologne), the Minerva Foundation (Bonn), and the Edelstein Center for the History and Philosophy of Science (Jerusalem) for financial support at various times, and to the Institute for Advanced Study in Berlin for bringing two of us back to Berlin for a year.

We also thank Mr. E. J. Aiton, the British Society for the History of Science, Cambridge University Press, Mrs. I. E. Drabkin, Mr. Stillman Drake, Kluwer Publishers, Wall & Emerson, Inc., and the University of Wisconsin Press for permission to use or modify figures or translations. In particular, we want to thank the Biblioteca Nazionale, Florence, for making accessible its entire collection of Galileo manuscripts and for permission to reproduce some of them in facsimile. We also want to thank Franca Principe-Saba and Mara Miniati of the Institute and Museum of the History of Science (Florence), as well as its director Paulo Galluzzi, for the help and hospitality accorded to Renn while he studied the Galileo manuscripts. We should also like to thank the Springer Verlag's anonymous referee for an unusually thorough and helpful commentary on the original manuscript.

Finally we should like to acknowledge our debt to the scores of historians and philosophers of science whose editions, interpretations, and translations of 17th century scientists and philosophers we have used, abused, criticized and cannibalized.

Berlin, Boston, Constance, and Jerusalem

To the second edition 2003

In the dozen years that have passed since the first edition of this book went to press, a great deal of research has been done on Descartes and Galileo and the origins of modern science. There have also been very significant advances made in

the accessibility of sources and in technology for analyzing them. Not only have some previously inaccessible manuscripts been edited and published, but also many formerly scarce published works from the period are now freely accessible on the internet. Our own research has also continued, and recent historical work has increasingly taken up lines of thought developed in this book. In view of these advances and because the book has been out of print for some time, we have undertaken to produce a revised and somewhat expanded edition, in which we incorporate some of the most important new results.

We have expanded the discussion of the doctrine of proportions in Chapter 1. In Chapter 2 we have extended the analysis of Descartes' impact rules in order to make the role of traditional statics more perspicuous, and we have been able to take account of some recent research on Hobbes's theory of refraction when discussing Descartes' defense of his derivation of the sine law. The analysis of Galileo's early work in Chapter 3 can now specify more precisely the dates of some of Galileo's discoveries. For instance, Galileo's recognition of the parabolic trajectory of oblique projection – which we could only characterize as “before 1604” – can now on the basis of new comparative manuscript evidence be dated more precisely to 1592, thus significantly strengthening the argument.

We have also taken this occasion to review the arguments and to reexamine all the translations in the documents section, in particular with a view to terminological consistency. We have made a large number of minor improvements in both presentation and translation; and we have added five new documents and expanded two others. The updated bibliography includes not only the new sources and secondary literature cited in the text, but also lists all the most important new books and anthologies relevant to the questions at issue.

With our continuing research we have incurred new debts of gratitude: In particular we want once again to thank the Biblioteca Nazionale Centrale, Florence, as well as the Istituto e Museo di Storia della Scienza which have cooperated with us in making Galileo's notes on motion Ms. Gal. 72 freely accessible through the Internet. We thank the late Prof. Karl Schuhmann, who generously made available his unpublished transcriptions of Hobbes's optical manuscripts. A number of scholars have assisted us with hints, suggestions for improvement, corrections, and specific criticisms of the first edition text: We would like to thank Mohamed Abattouy, Jochen Büttner, Michele Camerota, Rivka Feldhay, Raymond Fredette, Paolo Galluzzi, Enrico Gamba, Stephen Gaukroger, Enrico Giusti, Wallace Hooper, Frank Horstmann, Daniele Napolitani, Carla Rita Palmerino, Matthias Schemmel, Tom Settle, Alan Shapiro, William Shea, K. I. Takahashi, Matteo Valleriani, and, in particular, the late Pierre Souffrin.

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