History of Science, History of Text edited by Karine Chemla

Boston Studies in the Philosophy of Science 238. Dordrecht: Springer, 2004. Pp. xxviii + 254. ISBN 978–1–4020–2320–0. Cloth € 181.90

Reviewed by
Annette Imhausen
Johannes Gutenberg University, Mainz
imhausen@mathematik.uni-mainz.de

This volume is the publication of a selection of the papers that were presented at a workshop in Berlin in 1995. It explores the relationship between scientific practices and their manifestation in the form of scientific writings. The 10 articles, organized in four sections (plus an introduction and epilogue), cover an unusually broad variety of cultures (Mesopotamia, China, Europe, India) and times (from 1700 BC up to the 19th century AD), and the diversity of topics is just as wide.

Karine Chemla provides the introduction to this volume [vii–xxvii], and she makes clear that it aims to tackle the issues from a global perspective and to abandon as invalid the separation of the content of a text from its physical manifestation or material culture. Each of the respective articles sheds light on one or more specific aspects of the interrelation between the creation, use, and understanding of scientific texts. This collection, therefore, presents a multitude of impressions for a 'professional reader' of any kind of scientific text.

Part 1, 'What is a Text?' consists of one article only: 'Spatial Organization of Ancient Chinese Texts (Preliminary Remarks)' by Vera Dorofeeva-Lichtmann. This article is well chosen to begin this collection, as it questions one fundamental aspect that most people implicitly associate with the notion of a 'text', that is, a linear structure. The examples presented by Dorofeeva-Lichtmann of ancient Chinese texts are those where additional meaning is conveyed through a non-linear structure, i.e., by the positioning of elements of the text. The spatial arrangements can be linked to points of the compass. The evidence from China enables a scholar furthermore to trace the development from the non-linear layout found on bamboo slips, through silk manuscripts serving as a 'blue-print' of the non-linear layout [13: see also Figure 6a on p. 19], to the linear layout found in block-printed

ISSN 1549–4497 (online) ISSN 1549–4470 (print) ISSN 1549–4489 (CD-ROM)
Aestimatio 5 (2008) 47–54

books. The use of some non-linear texts required the moving (turning) of the text or of its user around it, and can therefore be linked to astronomical instruments such as the *shi* cosmograph (an astronomical instrument used to track the movement of heavenly bodies). The non-linear arrangement of bamboo slips would only have been displayed when the text was in use by a specialized user, and so it served as a way of safeguarding what was considered secret knowledge.

Part 2, 'The Constitution of Scientific Texts: From Draft to *Opera Omnia*', includes three articles: 'Leibniz and the Use of Manuscripts: Text as Process' (Eberhard Knobloch), '*Opera Omnia*: The Production of Cultural Authority' (Michael Cahn), and 'Writing Works: A Reaction to Michael Cahn's Paper' (Hans-Jörg Rheinberger).

Knobloch opposes 'published texts' and the handwritten output of Leibniz's mathematical work (about 50,000 items) in the light of on a quotation by Leibniz himself, 'Those who know me on the basis of my publications, don't know me' [51], and draws on the latter type of text for his argument. He describes how Leibniz used tables, illustrations, and figures to derive conclusions, visualize his ideas, and revise his work. The article thus looks at the role that 'text' (in this case handwritten notes), tables, and figures may play in the actual work of a scientist (mathematician). The available corpus of Leibniz's mathematical manuscripts is detailed enough to follow the evolution of specific ideas, e.g., the distribution of prime numbers [57–63], as well as the process of editing treatises (some of which he ultimately published), e.g., treatises on the arithmetical squaring of the circle, ellipse, and hyperbola [73], a legal-mathematical memoir on the simple rebate [73–75], and a treatise on life annuities [75].

With Cahn's article, we move to the other end of the spectrum, i.e., to the published text in the form of collected works. As he states initially, *opera omnia* have a rather special standing in that they come first in the catalogues of librarians, but last (if at all) in bibliographical research [82]. As Cahn notices towards the end of his contribution,

> collected works standardize all texts of one author into one single format. They cancel the historical singularity of their original modes of publication, and they cancel the differences between the texts which make it up. They murder any text and make them all look exactly the same, all sterilized to

> the same degree, free from the typographical accidents of history, and divorced from contemporary debates and contexts in which these writings were first produced and later re-used. [92]

What then, is the merit of collected works, and why are they so popular? Cahn's analysis reveals that the underlying motive is, above all, political. While the naive reader may think of collected works as a guarantee for a 'reliable, authoritative text' [83], they are also intrinsically linked to politics, status, and power. Various aspects of these underlying motives are studied throughout the article, pointing to the conclusion that collected works 'can alter texts without altering their words' [92] and that such works are worthy of detailed study.

The contribution by Rheinberger takes up a problem indicated by Cahn, that collected works cannot be *written* but must be *edited.* Rheinberger showcases collected works of scientists from the second half of the 18th to the first half of the 20th century. His first example concerns Pierre Louis Moreau de Maupertuis (1698–1759), who edited his own collected works during his lifetime, producing several editions (1744, 1752, 1753 and 1756) which make plain 'the unsolved dilemma of attempting to assemble complete works before the work has been completed' [96]. The central part of Rheinberger's article focuses on Georges Louis Leclerc de Buffon (1707–1788) and his 36 volumes of *Natural History* (1749–1789), which Rheinberger takes as an example of *writing* collected works. Rheinberger examines not only how Buffon himself approached the project and handled its inherent problems, e.g., the change of views over time, but also the reception of the *Natural History* during Buffon's life and after his death:

> 'Buffon' became a synonym for natural history for a major part of the nineteenth century. Ironically, Lanessan's critical edition... also marks the end of its pervasive cultural influence and the transformation of Buffon's writings into an object of purely historical interest. [100]

Part 3, 'How Scientific and Technical Texts Adhere to Local Cultures' takes the reader back to China ('Text, Representation and Technique in Early Modern China' by Craig Clunas), then France ('The Algebraic Art of Discourse: Algebraic *Dispositio*, Invention and Imitation in Sixteenth-Century France' by Giovanna C. Cifoletti) and

India ('Ancient Sanskrit Mathematics: An Oral Tradition and a Written Literature' by Pierre-Sylvain Filliozat).

The essay by Craig Clunas examines the attitudes towards scientific books of the literate elite of Ming China (15th–16th centuries). It begins with an anecdote in which a father's offer to his favored second son to pass on his skills and knowledge of numerology is met by a flat refusal, which then leads the father to order that all his books on the subject are burned. Clunas examines the situation of the family and the social context of numerology at the time to explain this episode. In doing so, he also raises questions about the use and social connotations of technical texts in Ming China.

Giovanna Cifoletti's contribution on algebraic discourse in 16th-century France studies the relations between developments in 16th-century algebra and its contemporary humanist traditions and practices (most notably linguistics). She uses the example of Jacques Peletier du Mans and his *L'Algèbre*, which was published in 1554 and was 'the first printed book on algebra in French and the richest among vernacular books on algebra' [125]. Cifoletti argues that Peletier reshaped algebra according to a humanist model, resulting in a new kind of text.

The final article in part 3 by Pierre-Sylvain Filliozat looks at ancient Sanskrit mathematics and its evolution from an oral tradition to a written literature. After a brief description of the pandits (learned men) whose knowledge included grammar, exegesis, and logic, he begins with a description of the Vedic civilization (*ca* 1300 BC until the beginning of the common era), which apparently transmitted its body of knowledge orally. In this context, text is understood as 'oral text'—no written form existed. Instead, knowledge was preserved using techniques of oral transmission (recitation, memorization, and conservation) [138]. The masterpiece of this tradition is the genre of the *sutra*, 'the mnemonic form par excellence' [140], which is formally characterized according to Filliozat by the

> use of ellipsis extended beyond the tolerance of natural language, multiplication of technical names to avoid descriptive expressions; abridged lists through mention of only the first and the last items, use of markers, and use of variables. [140–141]

Sulba-sutras (*Formularies of the Cord*) occur as a section of ritual literature in the *sutra* form. They deal with geometric problems occurring in a ritual context. Again, these texts originated as oral texts. Filliozat uses the example of the construction of a domestic fire-altar to introduce the reader to the style and content of this genre. Following a description of the emergence and use of writing and its contribution to Indian mathematics, he ends his account with an analysis of Sanskrit mathematical texts [148–156] and the role of orality in Sanskrit mathematics which includes sections about the place value numeral system [150–151] according to Aryabhata.

The final part ('Reading Texts') takes us back to antiquity again with the contributions by Reviel Netz ('The Limits of Text in Greek Mathematics') and Jim Ritter ('Reading Strasbourg 368: A Thrice-Told Tale'). They are followed by Karin Chemla's 'What is the Content of This Book? A Plea for Developing History of Science and History of Text Conjointly'. The first two contributions of this section complement each other beautifully—both deal with reading ancient mathematical texts; but, while Netz focuses on the role of text and its limitations using Greek mathematical examples, Ritter chooses to enhance the reading of an example of a Mesopotamian mathematical text by contrasting it with other related texts.

Netz discusses the role of other 'non-textual' elements of Greek mathematical texts. The examples he focuses on are diagrams and orality. He explicitly confines the sense of 'text' to 'verbal written aspect' [161], thus using a much narrower definition than that used by other authors in this book (most notably by Filliozat in his study of the 'oral texts' of Vedic culture). The very manner in which Greek mathematical texts have survived, i.e., mostly without the diagrams that one is so used to looking at when following a proof in editions by Heiberg or Heath, justifies this approach. In dealing with diagrams, Netz distinguishes between a 'global' reading and a 'local' reading:

> In the global way, we read the mathematical proposition from beginning to end, forming a rough impression of what it is trying to say; from the general context, we know the kinds of problems of interest; we have expectations of mathematical relevance; and through the combination of these we gradually may reconstruct a diagram which fits the text and which makes what we see as the 'correct mathematical sense'. [166]

The local reading, in comparison, follows the text step by step while constructing the diagram at the same time. It is through the process of locally reconstructing diagrams that one discovers the under-specifications in the Greek text which occur in a total of 8% of the propositions in book 13 of Euclid's *Elements* and in 37% of the propositions in book 1 of Apollonius' *Conics*. Clearly, the diagrams that we are so used to from our modern editions of the Greek mathematical texts are an integral part of the whole, or, as Netz puts it: 'the text and the diagram present... a cohabitation' [171]. The second observation to be made in this contribution concerns cross-referencing to previously established results. Again, given the practice in modern editions, when a previously proven theorem is used, we are used to a precise, explicit reference to its number. In contrast, as Netz notes for the Greek originals 'usually nothing happens explicitly' [173]. Netz argues that the reason for this lack of precise referencing is to be sought in the oral practice of Greek mathematics. In conclusion, Greek mathematics, which we think we know chiefly from its extant texts, has in fact a 'dual nature, both very oral and very written and... both very visual and very verbal' [175]. Taking these characteristics into account may increase our insight into Greek mathematical practice in the same way that Ritter's method of analyzing Mesopotamian and Egyptian texts has done for those cultures.

Jim Ritter has elsewhere argued that we should respect the formal characteristics of Mesopotamian and Egyptian mathematical texts. In his essay, he reintroduces his method of analyzing Mesopotamian mathematical problems by rewriting them in the form of symbolic algorithms which respect the procedural structure of the texts and provide a way of analyzing these structures and comparing problems more easily. In addition to the comparison with contemporary Old Babylonian mathematical texts, Ritter also contrasts his example of a Mesopotamian mathematical problem [Strasbourg 368] with Egyptian mathematical texts as well as Old Babylonian divinatory, medical, and legal 'practice' texts. Each of these comparisons provides further insights into the specific character of Strasbourg 368 and demonstrates a new method of reading ancient texts—which is usually much less straightforward than the beginning chapters of big overview histories of science make it appear: 'lacunae in the texts, hapaxes, a technical vocabulary for which it is difficult or impossible to fix the semantic referents' [177] are only some of the obstacles a historian of ancient science has to overcome in reading ancient texts.

The article by Karine Chemla uses two examples to argue for collaboration between history of science and history of text. The example of the 13th century Chinese text *Sea-Mirror of the Circle Measurements* by Li Ye serves to highlight the pitfalls of naively reading a scientific text of another culture and/or age under the assumption that 'science' is universal, i.e., as if

> texts as such, except for the emergence of modern symbolism, had no history, as if they were invariant in time and space, as if they had always required the same operations from their readers, as if the same elements always meant the same things. [202]

Instead, as Chemla demonstrates, 'the kind of reading which would turn them into their modern counterparts might completely miss the way in which they make sense' and 'one would fail to grasp what is at stake mathematically' [216]. The second example from 18th century Europe deals with the structure and notations of a *Mémoire* by Euler published in 1753. The careful analysis of Euler's text leads to the insight that whole sections of it correspond to each other and can be obtained through systematic transformation. That this is not a coincidence becomes apparent when a mistake by Euler made in paragraph 22 is then 'translated' in paragraph 24 [220–222]. Again, it is proven that it is critical to analyze a mathematical phenomenon in a particular source; the type of text that is created to communicate it is not simply a means of conveying mathematical content, but has its own contribution to make in our understanding of the phenomenon.

The volume closes with an epilogue by David R. Olson ('Knowledge and Its Artifacts') who points out the role of text in the representation of knowledge:

> by creating texts in which statements, formula and images serve a representational function, one comes to deal not with the world but with the world as depicted or described. [231]

Olson looks at writing and reading texts in various periods and concludes that changes in our means of writing and our way of reading influence (the representation of) our knowledge deeply, thereby giving a final argument for the interconnection between the history of science and the history of text.

Throughout, the volume contains numerous black and white illustrations of excellent quality. The variety of topics and the quality of the individual contributions renders this book a veritable goldmine for anyone working with texts. It points out various approaches a researcher can take, and indicates the pitfalls of a naive attitude towards texts. While part of the book's appeal lies in its global approach, I hope that it will soon be followed by a series of specialized studies.