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Textbooks on the Map of Science Studies

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The subject of this volume is resolutely on the periphery of everything. First the mainstream history of science with its categories and periodization has been shaped through intensive investigation of such countries as UK, France and Germany that are viewed as the center. Only a few decades ago, the center–periphery issue emerged as a topic deserving scholarship. And the STEP program in which this book originated testifies for the innovative power of a decentralized approach to the history of science and technology.

Furthermore, this volume is also on the margins of the center–periphery trend as most of the contributions to this volume seem to undermine the very relevance of the categories of 'center' and ''periphery''. Instead of a one-way flux of knowledge from the center to the peripheries, from science producers to the receptors of scientific knowledge, the chapters in this volume describe various cultures of science embedded in national traditions and adapted to local demands.

Thirdly this volume focuses on one of the most marginal aspects of science. Textbooks are not usually considered as central in scientific activity. Rather the writing of textbooks is viewed as ''the last existential act in science'' as John Hedley Brook remarked by contrast with conversations and research papers being ''the first existential act''.[1] Historians of science occasionally mention textbooks written by star scientists such as Lavoisier's *Elements of Chemistry*, Maxwell's Treatise on *Electricity and Magnetism* or Cuvier's *Leçons d'anatomie comparée* as they try to uncover all the facets of their lives but they usually pay no attention to textbooks authored by more obscure writers who consequently never enter the great History. Why should textbooks be of interest for historians as long as they are specifically meant for didactic purposes rather than for advancing knowledge? They tell nothing about the painstaking efforts, about the enthusiasm and fierce struggles involved in the construction of scientific facts. More exactly they tell something only in so far as they emphasize the divorce between science creators and the anonymous crowd of science transmitters. The latter hardly deserve the title of ''scientist'' whatever knowledgeable they might be, and the more glamorous title of 'savant' should be reserved for innovative people who contributed to the advancement of knowledge. Alphonse de Candolle, a famous

Swiss naturalist, thus rejected textbooks writers from his *Histoire des sciences et des savants*.[2]

The sharp distinction between creative science and expository science seems intuitive and quite natural nowadays. It is in fact closely related with the emergence of textbook as a literary genre. As Patinotis mentions in his paper, the term 'textbook' only emerged in 1730 and was largely used only towards the end of the 18th century. The writing of books for didactic purposes largely antedated the introduction of the term. In addition the term was coined in keeping with a scholastic pedagogy. ''Textbook'' initially referred to a printed version of a classic work with double space lines allowing the student to insert his or her remarks under the guidance of the schoolmaster. Thus textbooks initially belonged to a textual tradition focused on commentary rather than to a scientific tradition based on the observation of nature and oriented towards innovation. Nevertheless printing played a crucial role in the history of Western science as a number of scholars convincingly argued.[3] Many treatises of science were published in the 18th century that helped shape the disciplinary profiles of natural sciences. Yet textbooks turned into an independent and characteristic genre of scientific publication only in the 19th century when science education became compulsory in a number of European universities as well as in primary and secondary education.[4] Textbooks are material and commercial products subjected to the technical, financial, and political constraints of the publishing market.

Clearly if textbooks only enjoy an outsiders' position in the history of science they also belong to the history of education as well as to the history of books and reading. It is precisely because of their position at the intersection of three research fields that textbooks are interesting. Insofar as textbook writers are confined on the margins of scientific communities and belong to educational institutions, they share various cultures and they are under strong social, economic, and political pressures. As Kathryn Olesko emphasized, teaching spaces enhance the economic, social, and political forces that shape the organisation of scientific knowledge.[5]

Textbooks are supposedly good to teach the essentials of a discipline or more advanced knowledge to students, but what can we learn from them as historians of science? First we learn that teaching is not a marginal aspect of scientific activity. Not only because is it indispensable for training new generations of scientists or because it enriches our view of science as a social and cultural activity, but also because it determines the disciplinary partitions of scientific knowledge. Textbooks are crucial in this respect because they are sorts of archaeological traces of former regimes of knowledge. They teach us that the divorce between knowledge production and knowledge transmission was crucial for the emergence of positive sciences, as Auguste Comte clearly stated in his *Cours de philosophie positive*. Because no individual can go

through all the steps made by mankind in a lifetime, teaching required a consistent and organic reconstruction of knowledge independent from the actual process of knowledge production. Comte named it "the dogmatic order" by contrast to the "historical order" of exposition.[6] More than a simple gap, the dichotomy between the dogmatic and the historical orders required making a choice because attempts to combine them resulted in poor and biased accounts of the past.

Whereas historians of science ignored textbooks because of the gulf between producing science and communicating science, a number of philosophers of science have emphasized their importance due to this gulf. Gaston Bachelard, for instance, insisted that the divorce was a characteristic feature of the scientific age, the unavoidable consequence of the break (the rupture) between the pre-scientific and the scientific spirits. The scientific spirit has to be "trained in official laboratories and codified in school textbooks." Bachelard stressed that physics textbooks were repetitive and under a strict control. They were not descriptive but prescriptive, not really meant for transmitting science but rather commandments.[7] Thomas Kuhn also recognized the importance of textbooks for the stabilization and perpetuation of paradigms. Textbooks are fundamentally conservative as they are meant for training students in solving the puzzles raised within the paradigm rather than inventing new problems.[8] Kuhn argued that they assume their conservative function through various ways. They present only established and incontrovertible knowledge, the stable results of past revolutions. They regularly occult revolutions either by eliminating history or by presenting the present state of knowledge as the end product of a linear accumulation of data. They consequently disguise the actual procedures both of discovery and justification. As training tools and rituals of introduction in a community, they are powerful precisely because they stabilize the discipline in denying scientific changes.

For Bachelard and Kuhn textbooks are powerful tools because they are dogmatic and conservative thus distorting the real nature of scientific activity for didactic purposes. However the chapters in this volume addressing the question how textbooks reflected scientific revolutions may destabilize this assumption. Three case studies dealing with the echoes of the chemical revolution in Italian, Spanish, and Portuguese textbooks convey the view that Lavoisier's chemistry was perceived as a paradigm shift only by a minority of chemists whereas many chemical communities in Europe rather described and spread it as a partial change that did not affect wholesale. Far from delivering a biased view of scientific change this continuist interpretation of Lavoisier revolution rather meets the conclusions of most recent scholarship.[9]

While Comte, Bachelard, and Kuhn all agreed that textbooks are crucial for understanding science, none of them envisioned a possible impact of the

audience on the contents of a discipline. In this respect, the study of textbooks in the peripheries can play a central role. The chapters in this volume are all concerned with the differences of audiences and the variety of contexts of reading. They clearly show that textbook authors or translators from peripheral countries did not transfer or translate the knowledge produced in the leading countries into Greece, or Spain for instance. Rather they travelled from places to places, and selectively picked what was of use for their local purposes. They built up their own framework out of building blocks taken from various sites. The chapters in this volume suggest that the diffusion of science was by no means a sort of import trade into underdeveloped countries. It was not even just an acculturation or appropriation of a foreign tradition to local contexts. Rather this volume depicting science travelling from locality to locality suggests that scientific practice consists in various subcultures strongly connected by various exchanges and transactions. Thus Peter Galison's notion of 'trading zones' might be "appropriated" in order to reshape the center/periphery issue.

Notes

[1] Brooke, J.H.: 2000, 'Introduction: The study of chemical textbooks', in Lundgren, A. & Bensaude-Vincent, B. (eds), *Communicating Chemistry: Textbooks and their Audiences, 1789–1939*, Canton, MA, Science History Publications, pp. 1–18, on p. 1.

[2] de Candolle, A.: 1873, *Histoire des sciences et des savants depuis deux siècles*, H. Georg éditeur, Genève, Bâle, Lyon, p. 28; re-edition Paris, Fayard, 1988.

[3] Eisenstein, E.: 1983, *The Printing Revolution in Early Modern Europe*, Cambridge University Press, Cambridge; Johns, A.: 1998, *The Nature of the Book, Print and Knowledge in the Making*, Chicago University Press, Chicago; and for the chemistry case, Hannaway, O.: 1974, *The Chemist and the Word, The didactic Origins of Chemistry*, Baltimore, Johns Hopkins University.

[4] On the emergence of textbooks as an editorial genre see Bensaude-Vincent, B., Garcia Belmar, A. & Bertomeu-Sánchez, J. R.: 2003, *L'émergence d'une science des manuels. Les livres de chimie en France (1789–1852)* Paris, éditions des archives contemporaines.

[5] Olesko, K.: 1991, *Physics as a Calling: Discipline and Practice in the Königsberg Seminar for Physics*, Ithaca, Cornell University Press, pp. 15–16.

[6] Comte A.: 1975 [1830], *Cours de philosophie positive*, Paris: Hermann, 2nd Leçon, Vol. 1, pp. 50–51.

[7] Bachelard G.: 1972 [1938], *La Formation de l'esprit scientifique*, Paris, Vrin, pp. 24–28.

[8] Kuhn, Th.: 1962, *The Structure of Scientific Revolutions*, Chicago, University of Chicago Press and *idem*, 1977, *The Essential Tension*, Chicago, University of Chicago Press.

[9] See for instance Holmes, F.L.: 1988, 'Lavoisier's Conceptual Passage', *Osiris, 2nd Series*, **4**, 82–92.; Holmes, F.L.: 1989, *Eighteenth-Century Chemistry as an Investigative Enterprise* , University of California at Berkeley; B. Bensaude-Vincent & F. Abbri (eds.): 1995, *Lavoisier in European Context. Negotiating a New Language for Chemistry*, Science History Publications, Cambridge Mass.