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Historia Mathematica ●● (●●●●) ●●●—●●●

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Book review

L'Algèbre arabe. Genèse d'un art

By Ahmed Djebbar. Préface de Bernard Maitte. Paris (« Inflexions », collection dirigée par Jean Rosmorduc; Vuibert/ADAPT-SNES). 2005. ISBN 2 7117 5381 6 (Vuibert), 2 9096 8065 7 (ADAPT). viii + 212 pp.

A widespread view of the history of Arabic algebra perceives it through al-Khwārizmī, Abū Kāmil, al-Karājī (more precisely, his *Fakhrī*), and al-Khayyāmī alone—and through its impact in Europe as mediated by the Latin translations of al-Khwārizmī and Leonardo Fibonacci's *Liber abbaci*. For those who have followed the publications in the field over the past 30 years or so it is obvious that this picture mistakes four impressive buildings for a landscape, but their knowledge has not reached the general republic of historians of mathematics; *a fortiori*, it is not well diffused among those members of the broader public—for instance, mathematics teachers—who nourish interests in such matters.

This situation is changed by the book under review. Djebbar, perhaps more active than anybody else in the exploration of the Arabic algebraic landscape, addresses his account of it not to professional colleagues but precisely to the general interested public. He builds it not only on a wide range of published mathematical works (often published solely in the original language) and manuscripts and the references within these to other no longer accessible works but also on the medieval Arabic bio- and bibliographic literature.

Much ink has been used during the last three or four decades on essentialist discussions of whether there was a Babylonian, a Greek, or a medieval algebra, or *algebra* was created by Viète and his successors—or perhaps only took its beginning with Emmy Noether. Leo Corry [2004, 397], finding the question about the essence of algebra “ill-posed,” suggested that it might be more appropriate to “ask ‘What is the algebra of Fermat, Descartes and Viète?’ or ‘What is van der Waerden’s algebra?’” or even, “What was the algebra of the Greeks?” and then discuss whether “the Greeks were, or were not, doing algebra like it was later done in the seventeenth century, or like it is done in the twentieth century.” Djebbar follows the same principle. A general characterization is already offered in the title: Islamic algebra was an *art*, that is, a discipline and a technique, no body of theory. But a technique which was worked on actively for more than half a millennium certainly did not retain the same particular characteristics (actually, Arabic algebra changed more during this period than Archimedean geometric theory during the first 1700 years after Archimedes’s death, active further elaboration in the Arabic and Latin Middle Ages notwithstanding). Djebbar’s book does much to trace this development of the particulars.

The main exposition (pp. 11–122) is a well-read narrative that does not go deep into technicalities. It is followed, however, by four appendixes, one of which (pp. 147–180) contains text selections. Admittedly, even these cannot go very deep, since they consist of isolated problem solutions (in the case of al-Khayyāmī, the discussion of a single equation); their primary function is to give the reader a feeling of the flavor and also, via a translation into modern equation language, an idea of the types of mathematics involved. The other appendixes are a collection of 62 short biographies (pp. 123–145) of Arabic mathematicians mentioned in the narrative; two texts (by al-Samaw’al and al-Khawwām) speaking about unsolved problems (pp. 181–184); and an explanation of technical mathematical terms (pp. 185–190).

The narrative begins with a short description of the historical context within which Arabic algebra emerged—the translation period, and the beginning of scientific production; it is closed by a brief exposition of the arrival of Arabic algebra in Europe. The bulk falls into two parts, one (pp. 19–72) discussing developments in the Islamic Orient, the other (pp. 73–103) those of the West—the Maghreb and al-Andalus (Muslim Spain). Djebbar apologizes for having given (almost) equal space to the two, but justifies it by the discovery of many new documents from the West since 1980. He abstains from mentioning that he himself has been the main person responsible for this, in part through his own discoveries, in part through the generation of younger scholars he has put on the track; one might add that due to

doi:10.1016/j.hm.2006.07.001

1 these discoveries we are now probably better equipped to portray a genuine *environment* for the practice of algebra in 1
2 the Islamic West than in the East. Authorial modesty apart, there is absolutely no reason to apologize! 2

3 Djebbar refrains from making hypotheses concerning the pre-al-Khwārizmian roots of algebra, leaving it to still on- 3
4 going research to sort out the different strands that may have gone into it—some indefinite Persian–Indian connection, 4
5 metrogeometrical problems of Babylonian descent, ancient Greek “theoretical arithmetic” in the manner of Diophan- 5
6 tus, etc.—while pointing to counterarguments speaking against several of the explanations that have sometimes been 6
7 proposed. Positively, he starts at the point where al-Khwārizmī (or possibly his near-contemporary ibn Turk—Djebbar 7
8 discusses the priority problem but does not decide) picked up the technique and transformed it into a genuine art and 8
9 discipline. 9

10 Most of what follows in the treatment of the East will sound more or less familiar to those who have followed 10
11 the specialist literature of the last 30 years. Of particular importance is of course the treatment of indeterminate 11
12 problems—not *only* in the wake of the translation of Diophantus; the treatment of irrationals; polynomial algebra; and 12
13 the classification and geometric solution of cubic equations. In contrast, even near-specialists will find much new in 13
14 the treatment of the developments in the West, in particular regarding the mathematicians of al-Andalus, the strong 14
15 interactions between al-Andalus and Maghreb mathematicians (many important figures being active in both areas), and 15
16 the characteristic features of the Western algebraic tradition. Noteworthy among these features are the reordering of 16
17 the algebraic cases; the integration of algebra with *mu'amalat* mathematics (commercial mathematics in a wide sense, 17
18 which along with genuine or pretended merchants' activity deals with work as well as soldiers' booty and women's 18
19 dowries); and, last but certainly not least, the introduction of symbolism going beyond mere syncopation—related in 19
20 spirit though not by descent to those schemes used in Indian algebra that Nesselmann [1842, 302] regarded as the 20
21 earliest instance of genuine symbolic algebra. All three features have indeed disappeared from the Maghreb-treatises 21
22 that are most easily accessible in translated print. 22

23 In the presentation, Djebbar points to several Arabic algebraists who undertook investigations similar to those that 23
24 we tend to see as a first step toward *algebra as theory* when we encounter them in Cardano's *Ars magna*—for instance, 24
25 the study of the relation between the coefficients of an equation and its roots. Avoiding the pitfall of history written in 25
26 the future perfect, Djebbar takes care *not* to claim that Arabic algebra was thereby stepping beyond the limits of the 26
27 “mere art,” but his readers may still take note. 27

28 Like all of us, Djebbar is a less certain guide when he leaves the area where he did his own work and enters 28
29 the Babylonian, Indian, or late medieval Italian area. Here he sometimes relies on outdated translations and unduly 29
30 modernizing interpretations, thereby missing interesting points. One instance is an Old Babylonian text borrowed 30
31 from Thureau-Dangin (p. 180), in a translation that hides the link to Arabic mensuration treatises. Another one is an 31
32 excerpt from Mahāvīrā reported indirectly (p. 179) from [Datta and Singh, 2001]; as can be seen from the English 32
33 translation in [Raṅgācārya, 1912, 62], Mahāvīrā does not speak of products of fractions but of “ $\frac{1}{4}$ of $\frac{1}{3}$,” etc., exactly 33
34 as done in Arabic (and Babylonian). But such peripheral flaws are unimportant. 34

35 Djebbar has written with a double purpose in mind; beyond producing an introduction to the field, he has wanted 35
36 to create an “instrument for work” (p. 6, transl. JH). As it turns out, this instrument has been intended mainly for 36
37 mathematics teachers who want to “deepen their understanding of the technical aspects of [Arabic] algebra or cull 37
38 some examples in order to enrich their teaching” (p. 7). This service for mathematics teaching is a most laudable aim, 38
39 and one that historians may easily forget to care for. However, historians feel slightly envious of the mathemat- 39
40 ics teachers and hope that Djebbar may find time in the not too distant a future to write another volume aimed at 40
41 specialists—along with the editions of the many intriguing texts which he cites. Instead of being the conclusion of 41
42 25 years of intense work on the Maghreb school of mathematics, we must hope that the beautiful book under review 42
43 announces a continuation of his research and publication program. 43

44 For the benefit of those mathematics teachers and other nonprofessional lovers of the history of mathematics who 44
45 do not read French, one may also hope for a translation, or rather for two: one into Arabic, the other into English. 45
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