Estratto

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*Observations and Reflections Concerning the First Volume
of a New Edition of the* Liber abbaci

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DI PAVIA

ATHENAEUM

Studi di Letteratura e Storia dell'Antichità

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Notizie di Pubblicazioni

OBSERVATIONS AND REFLECTIONS
CONCERNING THE FIRST VOLUME OF A NEW EDITION OF THE *LIBER ABBACI*

ABSTRACT.   Leonardo Fibonacci's *Liber abbaci* has so far been known only from Baldassarre Boncompagni's edition from 1857, based on a single 14th-century manuscript. In 2008, however, an editorial project was started at Università Federico II in Naples, which has now produced an edition of the introductory matters and the first four chapters of the work – in total 5% of Fibonacci's complete *Book on Calculation*. Unfortunately, the edition is problematic on several accounts. Firstly, the two editors know little about the subject matter dealt with by Fibonacci or about the historical context, which means that the commentary does not go much beyond conventional wisdom. Secondly, the editorial work itself is not always precise. Apart from presenting a translation into a modern vernacular (Italian), the new edition is unfortunately no decisive step forward compared to Boncompagni's edition of the Latin text.

The *Liber abbaci* (as I shall call it, both in order to respect Fibonacci's prevailing orthography and so as to distinguish the concept *abbacus*, approximately «practical calculation», from the reckoning board) was written in 1202 by Leonardo «from the house of the sons of Bonaccio», later contracted to «Fibonacci», outside his native town known as «from Pisa». In 1228, he prepared a revised edition dedicated to Michael Scotus, and until Cardano's time this book of some 250,000 words retained high prestige in the abbacus school environment while being much less influential than mostly assumed. After having been almost forgotten [1], Fibonacci was gradually brought back to light, first in the Italian 'Catholic Enlightenment', then by incipient Italian nationalism. The beginning was probably made when Giovanni Targioni Tozzetti inserted 14 pages about Fibonacci in the second edition of his *Relazioni d'alcuni viaggi fatti in diverse parti della Toscana* [Targioni Tozzetti 1768, pp. 58-72], with extracts from the *Liber abbaci* as well as the *Pratica geometrie*. Gabriele Grimaldi soon dedicated 59 pages to a biography [Grimaldi 1790, pp. 161-219]. Finally, Fibonacci was established definitively as an important figure in the historiography of mathematics and elevated to heroic status by Pietro Cossali in *Origine, trasporto in Italia, primi progressi in essa dell'algebra* [Cossali 1797], while Guglielmo Libri printed two excerpts of the *Liber abbaci* (initial matters and the complete chapter 15) in *Histoire des mathématiques en Italie* [Libri 1838, II, pp. 287-479]. In 1851, Baldassare Boncompagni published a long article *Della vita e delle opere di Leonardo Pisano matematico del secolo decimoterzo* [Boncompagni 1851], followed by *Intorno ad alcune opere di Leonardo Pisano* [Boncompagni 1854a] and by a first edition of some *opusculi* [Boncompagni 1854b]. Finally, in 1857, Boncompagni published an edition of the *Liber abbaci* [Boncompagni 1857], followed in 1862 by the *Pratica geometrie* and, once again, the *opusculi* [Boncompagni 1862]. All of these extracts and editions were made on the basis of single manuscripts, and carry little or no analysis, explanations or commentary.

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* Essay review (not peer reviewed) of Giuseppe Germano and Nicoletta Rozza (ed.): Leonardo Pisano detto il Fibonacci, *Liber Abaci. Il libro del calcolo. Epistola a Michele Scoto - Prologo - Indice - Capitoli I-IV*, edizione critica, con introduzione, traduzione e note a c. di G. G. - N. R. (Collana di Studi e Testi della Latinità medievale e umanistica 4), Napoli, Paolo Loffredo 2019, pp. 252. Written before Enrico Giusti's full edition of the *Liber abbaci* was published, cf. *zbMATH Open Zbl* 1457.01028 (https://zbmath.org/?q=ai%3Aleonardo-of.pisa.+py%3A2020).

[1] Montucla dedicates some seven lines of his *Histoire des mathématiques* to Fibonacci [Montucla 1758, I, pp. 441, 476], believing that a work he had planned (presumably the *Liber abbaci*) was never written.

Boncompagni 1857 was the basis for the recent English translation [Sigler 2002], while the Chinese translation [Ji 2008] was based on Sigler. In 1981, I was privately informed about a projected critical edition, confirmed in 2000, but nothing appears to have come out of it. The new Naples edition project is therefore most welcome [2].

The Naples project was started too ambitiously in 2008, and therefore got stuck – those colleagues who wanted a glittering interactive multimedia show with movies, etc. could not wait for the philological work to be done. The project was restarted for good in 2017. The first outcome is the volume under review, which contains a critical edition with Italian translation of the introductory material (dedication, prologue and table of contents) and the first four of fifteen chapters – short chapters, in total some 5% of the whole work (23 out of 459 pages in the Boncompagni edition).

For a long time, nine complete or almost complete manuscripts of the *Liber abbaci* have been known. To these come a number of manuscripts containing single chapters. However, none of the latter contain material from the first four chapters, and they have therefore not served for the present edition. Of the nine complete manuscripts, one is a late copy of an extant 14th-century manuscript, and even this one has therefore (quite reasonably) been discarded.

The edition and translation are preceded by a preface («Premessa») and a five-section introduction: (1) a programmatic statement «Per una moderna edizione critica» credited to Giuseppe Germano, including also an appreciation of Fibonacci's importance and some elements of historiography; (2) «La vita, le opere e la fortuna di Leonardo Pisano», like the next two chapters credited to Nicoletta Rozza; (3) «Le fonti del *Liber abaci*»; (4) «La tradizione manoscritta del *Liber abaci*», with description of all known complete and partial testimonies; and (5), «Classificazione dei testimoni utilizzati», signed by both editors, listing the singular readings of the eight manuscripts that are used, and constructing on this background a preliminary and explicitly hypothetical stemma (hypothetical not least because it is waiting for what the edition of further chapters will teach).

It is evidently a step forward to be able to check Boncompagni's text by comparing the readings of his 14th-century manuscript with what is found in the others – so far this has only been possible for the single paragraph edited by Grimm. However, a number of problems have to be mentioned.

Let us start with a passage from the preface (p. 8), stating the first purpose of the original project – the one which has survived – to be to procure

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[2] Two partial editions have also been made. In 1976, Richard E. Grimm made a critical edition with translation of the autobiographical paragraph of the dedication on the basis of the six known manuscripts that contain it [Grimm 1976], thereby showing that Fibonacci visited «Egypt, Syria, Greece, Sicily and Provence» *for the purpose of trade*, a point that has disappeared from explicit view in Boncompagni's text, and which offered Georg Eneström the possibility of another cheap and ill-informed attack on Moritz Cantor [Eneström 1906]. (Grimm, quite unusually and also different than the present edition, discusses the abbreviations and ligatures of the manuscripts, thus locating possible misreadings).

In 2017, Enrico Giusti published chapter 12 as contained in the manuscript Florence, Biblioteca Medicea Laurenziana, Ms. Gaddi 36 [Giusti 2017], which is different from the version published by Boncompagni and, according to strong internal evidence, older and thus probably, as argued by Giusti, the original 1202 version. Giuseppe Germano dismisses the latter with a rather contemptuous generic reference to the editor's «scarce methodological competence in the philological disciplines», supported only with a reference to an unpublished lecture (p. 48; reviewer's translation, as are all unreferenced translations in what follows). Grimm's contribution is used on p. 46 as an argument against Boncompagni's single-manuscript edition, but on p. 48 even Grimm is treated condescendingly.

the inescapable basis for the editorial linguistic-philological approach, with the aim to constitute for the first time a reliable critical text as close as possible to the original of the *Liber abbaci* and to provide it with a modern, efficient translation.

As we see, all manuscripts are presupposed to go back to a single text, «*the* original», which can be reconstructed; the critical text (p. 49) should «have the pretence to be as close as possible to the authentic and original shape intended by its author».

This should seem a reasonable goal, according to what is concluded on p. 109: that all manuscripts used for the edition [3] depend on a single manuscript, derived from Fibonacci's autograph yet already secondary. This latter conclusion is derived from a number of points where all manuscripts agree on a formulation which the editors cannot believe Fibonacci would have made. None of them are convincing – why, for example (p. 113), should Fibonacci have included a list of multiples of 1, just because such list is contained in the *Liber ysagogarum Alchorismi*, claimed without the slightest argument to be one of Fibonacci's sources (see below on these)? Most revealing is perhaps what is said on p. 113 about a passage explaining a proof by casting out nines from the multiplication $37 \cdot 37$,

> Et nota cum additis figuris de 37, scilicet 3 cum 7, tunc dividis 37 per 9, de qua divisione remanet 1.

This is certainly not elegant, but it is grammatically fairly acceptable and the meaning is clear: «And observe that with the added digits of 37, that is 3 with 7, you then divide 37 by 9, from which division 1 remains». According to the editors, however, it makes no sense, for which reason *dividis* must be an error for *divisis*. The result is a sequence containing a prepositional clause and an absolute ablative but no finite main clause within which they belong (what follows is a relative clause) – grammatically impossible, even in Fibonacci's uneven style.

Worse, the Latin text itself is dubious. In manuscript **V** (Vatican Library, ms. Palat. 1343 [4]), apparently the second-oldest extant manuscript, one reads without the slightest doubt *Et nota cum addis* [𝐚𝐝𝐝𝐢𝐬] *figuras...*, «and observe that when you add the digits...». Rozza's apparatus has no trace of that. If this happens in a place where a claimed concordant reading is used as a decisive argument, how much can we trust the precision of the rest [5]?

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[3] This excludes the manuscript made use of by Giusti (see note 2), since it is incomplete and does not contain any matter belonging within the first four chapters.

[4] A beautiful scanned version of this manuscript can be found at the website of Heidelberg University Library. Whereas the scan I bought from the Vatican Library in incomplete (62% are missing!) and in low resolution, this one is complete and in high resolution.

[5] While we are on this page 149, a misleading text emendation can be noticed. Fibonacci explains that «The residue that remains from any number divided by 9 is indeed the total [*summa*] that is engendered by the addition of all the digits that make up this number».

This is of course an incomplete statement, and Rozza adds <*cum ex eo extracta fuerunt 9*>, «when 9 have been extracted from it». With this emendation, the statement is no longer an incomplete hint but wrong (for the product in question, *viz* 1369, 9 has to be subtracted twice). As can be seen a few lines above and on p. 169, Fibonacci would accordingly have made use of an expression involving *9 quotiens potuerit* or *relictis novenis* (and since we do not know which, a restitution of what Fibonacci *would* have said is problematic). In the translation on p. 201, nothing shows that the (wrongly) added words do not come from Fibonacci. Actually, the only addition to the original text which is indicated as such in the translation is the title «Prologo».

The editors may themselves feel that their conclusions are not fully convincing (after all, as they point out, they are built on a small percentage of the complete work) – in their summary on p. 126 they admit the hypothesis that «the tradition depends on an archetype in movement» (that is, on a manuscript into which Fibonacci over the years introduced changes and marginal additions), which, if reflected in the extant manuscripts, would exclude that these should descend from a single secondary manuscript.

The main reason for this admission is the character of **V**. Precisely this manuscript calls for a general objection to the ecdotic approach. In the preface (p. 7), Germano laments that a «true and proper ecdotic theory [for the edition of technical and scientific texts] which considers the particularity of their diffusion and transmission» is still lacking. Maybe, but that should not prevent the application of common sense, and anybody working on (and not merely editing) Fibonacci's text will know that the calculation schemes in the margin are an integral part of the exposition, no mere secondary illustrations. If I do not err, they are spoken of nowhere in the volume under review, and it is not explained from which manuscript the ones that are reproduced are taken – apparently not from the manuscript used by Boncompagni but very similar. Now, even the most superficial inspection reveals that many of the diagrams reproduced by Boncompagni and the present editors are absent from **V**, while many of those which are there are strongly reduced (in particular lacking the rectangular frame that reproduces the board on which calculations are supposed to be performed). Comparison of these schemes would obviously be important for the construction of a stemma (however preliminary) and for judging the quality of the various manuscripts. Who does not see this is hardly in a position to characterize earlier editors of «technical and scientific texts» (say, from Paul Tannery and J.L. Heiberg to such contemporaries as Menso Folkerts and Charles Burnett, not to forget near-contemporaries such as Marshall Clagett, David Pingree and H.L.L. Busard) as generally

> experts in their respective scientific fields, experts who, however, often do not possess neither the practice nor sufficient theoretical insight in the field of philology and text criticism, with consequences that may injure not only and not so much the reconstruction of the intention of their authors as, first of all, the very history of the disciplines which these texts regard.

Five of the giants just mentioned and editions for which they are responsible are referred to by Rozza. Turning instead to Germano's preface and the first section of the introduction, we may observe that neither they nor their work, nor anything beyond weary commonplaces from the historiography of mathematics appears [6] – for instance (p. 43), Fibonacci «justifying with the rigour of a scientific method and fixating in writing a fair number of algorithms which before him had only been performed mentally in a mechanical and empirical way». Germano's references are generic, with no page indications, and what is attributed for instance to «Vogel 1970» (which should be «Vogel 1971» here and in the bibliography) is a pure invention. It would be a surprise if Germano should be able to exemplify the injurious effects of earlier work he refers to, or to substantiate the similar reference (p. 47) to the

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[6] It is possible that Germano thinks in the passage just quoted of such figures as Raffaella Franci and the late Gino Arrighi, who never intended (nor pretended) to make critical editions but made texts (often texts of which only a single manuscript exists) available with essential commentary – a work for which everybody really interested in the history of the areas on which they worked is immensely grateful.

abundant dangers hidden in the construction of complex scaffolds of thought on the basis of [Boncompagni's], text, more than problematic as regards integrity and authenticity.

Rozza's contributions to the volume – the edition of the four chapters, the translation, and sections 2-4 of the introduction – are more serious and never disturbingly patronizing. Unfortunately, even they are not without problems.

Section 2, on «the life, works and fortune» of Fibonacci, contains much conventional wisdom, not all of it trustworthy. In particular, the statement (p. 54) that «it was first of all thanks to the *Liber abbaci* [...] that the Hindu-Arabic number system was definitely established in Europe» is definitely wrong concerning Europe outside Italy. What was translated into vernaculars (an adequate measure of impact and importance), Icelandic as well as Anglo-Norman and Middle English, was Sacrobosco's *Algorismus vulgaris* (and more rarely Alexandre de Villedieu's *Carmen de algorismo*); even within Italy, Sacrobosco was influential – just look for his explanation that «zero means nothing but gives meaning» in abbacus books! All in all, «Vogel 1970» (as stated, actually Vogel 1971), Kurt Vogel's biography of Fibonacci in the *Dictionary of Scientific Biography*, is more informative and reliable.

The next title, «the sources of the *Liber abbaci*», is a misnomer. It presents the titles of a large number of mathematical works circulating somewhere in the Arabic or the Latin world during the 10th-12th centuries, but offers no evidence that Fibonacci knew or used them, beyond two references to Menso Folkerts' work concerning Fibonacci's use of Euclid. At first (p. 61) it is explicitly denied that Fibonacci should refer to other predecessors, but on p. 67 it is admitted as a possibility that a reference to «Admetus filius» [ed. Boncompagni 1857, p. 119] might speak about Aḥmad ibn Yūsuf (who had been translated by Gerard of Cremona); if Rozza had understood what is spoken about in the passage, she would have had no doubts. But after all, she is a philologist and not supposed to understand the subject matter.

On page 65 it is asserted that «a work about algebra with the title *Kitāb al-jabr wa'l muqābala* has been attributed to» al-Khwārizmī. Nobody else in the scholarly world has ever doubted the authorship. Moreover, if Rozza had read Miura 1981 or just compared the texts herself – not difficult – she would have seen that Fibonacci copies stretches of text from Gerard of Cremona's translation of that work, which is thus indubitably a source.

Even the evidence presented by Fibonacci's notations for composite fractions (used in the *Liber abbaci* from Chapter 5 onwards, as well as in Fibonacci's other works) shows him to have learned, not from a specific book (which cannot be pinpointed) but at least from late 12th-century Maghreb mathematics.

From where Rozza gets the idea (p. 66) that no Arabic manuscript of Abū Kāmil's algebra has survived is an enigma – she has a footnote referring to Roshdi Rashed's introduction to the edition of that very manuscript which explains exactly the opposite [Rashed 2012, pp. 7-9].

On one point, Rozza hints at an argument which, however, is not spelled out. On p. 67 she states that «certain characteristics of the argumentative logic and the specific terminology of Fibonacci's work are also encountered in» al-Uqlīdisī's *Book on the Chapters of Hindu Reckoning*. Obviously, the principles of place-value computation will easily be explained in analogous ways by different authors, and that both al-Uqlidīsī and Fibonacci speak of 1,000,000 as «thousand thousands» (p. 200 nt. 8) is hardly evidence of anything except that neither Arabic nor Latin of the time had a word «million». However, when Fibonacci casts out nines he speaks of the number which should be the same «left and right» in a calculation such as $37 \times 37 = 1,369$ as *pensa vel*

probatio. At first it is said about *pensa* (p. 210 nt. 6) that «the question of its meaning has been studied in depth [*è stata approfondita*]» by Concetta Carotenuto (a former collaborator in the project), who has «demonstrated that this noun was originally used to indicate the ration of daily provisions» – a rather pompous way to say that she has looked it up in a standard dictionary[7]. Carotenuto would have been better informed, had she inspected [Du Cange et al 1883, VI, p. 259], which tells the medieval widespread meaning to be «weight». However that may be, Rozza herself (who knows and uses Du Cange, see for example p. 235 notes 15, 16 and 19) suggests instead that it might have to do with al-Uqlīdidī's *mīzān*, used in the same function. This is a very good idea, though *not* evidence that Fibonacci used al-Uqlīdisī, since the same term is used in the same function at least by al-Kāsī and ibn al-Hā'īm, that is, from Afghanistan to North Africa [Souissi 1968, p. 348]. Since *mīzān* means «balance, scales, weight [etc.]» [Wehr 1961, p. 1065b], Fibonacci appears to have produced or (less likely) adopted a loan translation, which supports the assumption that he knew at least some Arabic; if Rozza has seen this, she does not tell.

To sum up, references elsewhere in the edition to some writing being a «source for Fibonacci» can be safely discarded as nothing better than prophetic utterings.

Concerning section 4, description of the manuscripts, I am not in a position to make serious objections, and suppose there would be no occasion to do so. I have one minor objection, an observation and a small correction.

Firstly: In a number of cases, watermarks are spoken of. Many of those that are found are not listed in Briquet 1923 – but when they are, why not use them as support for the dating of the manuscript[8]?

Secondly (an observation and no objection): It might be added to the description of **V** that two major lacuna represented by deliberately empty space on fols 55[rv] and 87[rv] show the manuscript to have been copied from an original where something could be seen to have been lost (the former corresponds to very close to 3 leaves, the latter to almost 8 leaves in Boncompagni's manuscript[9]; the former may thus correspond to the loss of three leaves, the second to that of a quire of 8 leaves).

Finally, a minor correction: The manuscript identified on p. 93 as «San Juan de Capistrano, CA, Library of Robert B. Joneyman Jr. (Rancho Los Cerritos), ms. Gen. Sci. 6» should be «Honeyman». Moreover, that library was dissolved long ago. As told in note 90 on the page, after having been auctioned the manuscript is now is private possession somewhere and the identification should thus probably carry an *olim*; the description is said to be borrowed from a web page belonging to the auction house Bonhams, which no longer exists and has not been archived on the Wayback Machine (https://archive.org.web).

Section 5, officially an outcome of joint work of both editors, is based almost exclusively on

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[7] Apparently Calonghi 1950, col. 1991 (or some other edition of that work), which has exactly these words and the same reference to Diocletian's edict; but Lewis-Short 1879, p. 1330c would also do.

[8] Watermarks seem to narrow down the date of manuscript **R** from «15th century» to the years 1440-1460; Firenze, Biblioteca Nazionale Centrale, Ms. Conv. soppr. C VIII. 2645, given as «14th century», appears to have been produced between 1320 and 1340. Perugia, Biblioteca Comunale Augusta, Ms. D 68, is narrowed down from «16th century» to the years around 1543.

[9] Top of fol. 57r to bottom of fol. 59v, and end of fol. 96v until beginning of fol. 104v.

Rozza's editorial work. It contains detailed lists of singular readings of the single manuscripts and of shared characteristics of subgroups (introductory matters and chapters 1-4 only). This serves in the end to construct the hypothetical stemma. The inherent problems have already been discussed.

As a rule, the critical apparatus to *the edition* (thus announced on p. 132) does not include the particular readings of single manuscripts that can be found in section 5 of the introduction – which means that anybody wishing to check a particular passage will have to consult not only the apparatus but eight more pages in the book. As we have seen, there are further omissions not covered at all, also in crucial passages.

Along with the apparatus, notes indicate what are claimed (p. 131) to be «probable sources and/or parallel passages». Often, these are simple references to passages in other works that deal with sometimes more, sometimes less similar topics; what was said about the claimed sources in section 2 of the introduction holds also here.

The restitutions of single missing words seem reasonable; a few (one example is given in note 5) are dubious.

The translation is introduced by an explanation of principles and inherent difficulties. It is mostly reasonable, but one mistake should be taken up because it reveals the bias of Germano as well as Rozza, both trained in Classical and Humanist Latin. In Fibonacci's table of contents, chapter 11 is said to treat «de consolamine monetarum». Sigler translates this as «on the alloying of money»; Rozza instead finds (p. 183) in an 18th-century encyclopedia [10] that *medaglie consolari* are called thus (namely, in 18th-century numismatics!) because they were minted when the Roman Republic was governed by Consuls, and therefore suggests it refers to alloying in the old, decent way, preceding later debasement. If familiar with near-contemporary related vernacular texts, she would have known that *consolare* is a regular Tuscan verb, explained by Benedetto da Firenze [11] [ed. Arrighi 1974, p. 36] as *mescolamento d'arieti* («mixing of silver»); it is used also in Francesco Pegolotti's *Pratica della mercatura* [ed. Evans 1936, pp. 340, 345]; in an abbacus-treatise from Lucca written around 1330 [ed. Arrighi 1973, pp. 11, 35, 94-97]; in Francesco Bortoli's *Memoriale* [ed. Sesiano 1984, p. 134] from *ca* 1400; and certainly in many other places. Parallel passages in the *Memoriale* show that Bartoli took *consolare* and *allegare* to be synonyms.

This is no isolated oversight, but symptomatic of a general problem. As pointed out by Rozza (p. 182),

> the language of medieval mathematics is characterized by the presence of certain terms that do not belong to the classical vocabulary of arithmetic but which are rather taken over from sectorial languages if not indeed from everyday linguistic habits.

This should be obvious: the «classical vocabulary of arithmetic» which she could find in Boethius or the Euclid translations speaks about numbers and not about trade, alloying or such topics. But Rozza overlooks that the «everyday linguistic habits» which Fibonacci has to draw on are those of the vernacular. He even does so in cases where it would have been possible to find a fitting word in Classical Latin; in later chapters one will encounter *viadium*/*viagium* for «travel»,

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[10] She gives the reference «Pivati 1747, vol. IV, p. 619», which should have been vol. VI, and indeed «Pivati 1746, vol. VI, p. 619».

[11] Relying on a wrong author indication in his manuscript, Arrighi ascribes the text to Pier Maria Calandri.

from *viaggio*; *maneries* for *maniera*; *naulegiare* for *noleggiare*: *baractare* for *barattere*; and *avere* as an occasional loan-translation of Arabic *māl*[12]. All could be borrowed from either Catalan-Provençal or Tuscan, but they are certainly not *bona fide* Latin – and the Humanists would have derided them as examples of corrupted Latin.

Some of the problems encountered by Rozza have nothing to do with the vernacular but simply with the insufficiency of even the best Latin standard dictionaries when confronted with mathematical texts. Stevens 2002 would have been an adequate aid, but that publication has not received the appreciation it deserves. However, Rozza makes a decent job of deciphering the technical meanings of such terms as *summa* from Fibonacci's own usage (cf. also note 13).

As to the translation itself, we may look at a passage from the original text (p. 148) compared to the translation (p. 208). First the original text:

> Verbi gratia ut si quesierit multiplicationem de 12 in 12, scribantur 12 bis in tabula dealbata, in qua littere leviter deleantur, sicuti in hac margine scriptum cernitur.

and then the translation:

> Ad esempio se si volesse conoscere il risultato della moltiplicazione di 12 per 12, si scriva 12 due volte su una tavola sbiancata, sulla quale le cifre possano essere facilmente cancellate, così come si vede raffigurato qui nel margine.

Obviously *quesierit* has to be provided with a subject in the translation, and the closest possible is the impersonal reflexive chosen by Rozza. The rest, with one exception, is almost *de verbo ad verbum*[13]. The exception, *littere* becoming *cifre*, has to do with failing understanding of *tabula dealbata* (the translation *tavola sbiancata* is unexceptionable in itself). A note explains it to be a «board of whitened wood used in the Middle Ages to write down operations and computations», which corresponds to what is almost certainly meant: a *lawha*, a wooden board covered with white clay, which was used in the Maghreb and on which writing is easily deleted by means of added clay – see Lamrabet 1994, p. 203 and Abdeljaouad 2005, pp. 36 s. However, Rozza then refers to two publications speaking of *Antiquity*, one of which, Blanck 2008, p. 66, as quoted by Rozza, specifies that the board in question was whitened with chalk or gypsum (whence not fit for deletion and rewriting). The next note explains that *littera* must be understood as a synonym for *figura* because *Dixit algorismus* [ed. Allard 1992, p. 9] tells to write a digit «in tabula vel in qualibet re alia quam volueris», «on a board or on whatever else you may wish». Rozza seems not to be aware that the *tabula* spoken of here is almost certainly a *dustboard*, nor to realize that this is in any case no argument: what Fibonacci explains is that a board shall be used on which *anything*, letters as well as digits, can be easily erased; there is no reason to rap Fibonacci's knuckles.

This tendency to change what Fibonacci says (and says correctly) into what Rozza feels he *should* have said mostly manifests itself when Fibonacci uses numbers as grammatical subjects. So, on p. 148 in the edition, «1 qui est» is corrected against all manuscripts into «1, quod est» – Rozza thinks that 1 *should be* neuter and not masculine. When the text states (p. 142) about the number

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[12] Most (and more) are taken note of already in Targioni Tozzetti 1768, p. 64, and repeated in Grimaldi 1790, p. 202.

[13] On p. 180 Rozza has explained that *multiplicatio* stands for «multiplication» as well as for *the outcome* of a multiplication, the product.

87654321 that, «De 1 namque quod [14] est in primo gradu dicet unum», Rozza explains that *dicet* requires as grammatical subject *quis*, not seeing that it is *the number 87654321* that «says».

These objections to the translation may be regarded as pedantic (they are!), and the reader who wants to get the gist of what Fibonacci thinks and prefers for convenience to use the translation will hardly be hurt. However, exactly the same can be said about almost all of the mistakes in Boncompagni's scorned edition or his manuscript. Rozza's either shallow or wrong mathematical explanations [15] will hardly disturb the reader who understands mathematics at this elementary level – no more than the absence of commentary in Boncompagni 1857.

On p. 48, Germano observes:

> Even though the importance of Fibonacci's *Liber abbaci* has repeatedly been held to be fundamental for the history of the mathematical sciences [16], his text still finds itself in the condition of not having received editorial care [*cura editoriale*] corresponding to its importance [...].

Unfortunately, this remains as true today as when it was written, even concerning the first four chapters. It is to be hoped that the present editorial undertaking will not block the publication of a future competent edition. The purpose of the present long and unpleasant review (unpleasant also to the reviewer, who apologizes) is to argue that it should not.

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[14] Even here, three of the manuscripts have *qui*.

[15] For example, the invention of «dissociativity» as a property of multiplication and the reference *hors propos* to associativity on p. 210 nt. 8.

[16] In Italian, «l'importanza [...] sia stata da più parti ritenuta fondante». Evidently, it must be the *Liber abbaci* itself and not its importance that has been regarded as fundamental. Germano's high-flown style appears to have overpowered his linguistic abilities.

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