Algorithmic in the 12th Century: the Carmen de Algorismo by Alexander de Villa Dei

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This paper aims to update the knowledge about one of the oldest medieval handbooks on calculation with Indo-Arabic numerals in positional notation, the so-called *Carmen de algorismo*, also known as *Algorismus metricus*. This poem is traditionally attributed to the French scholar Alexander de Villa Dei [1, 2], who also authored a very successful Latin grammar in verse, entitled *Doctrinale*.

During the Middle Ages, the *Carmen de algorismo* had remarkably spread in many European countries, alongside the *Algorismus prosaicus* by Johannes de Sacrobosco. Despite its undeniable historical importance, the work has not yet been thoroughly investigated both for its intrinsic difficulty, because it is composed in verse [3] by a refined author, and for the large presence of a rich contemporary literature of the same content, starting precisely from the one by Sacrobosco.

In our study, we at first discuss the version of text to analyse, as no critical edition of the work is now available, and the extant manuscripts differ from each other in many passages, as our synthetic census can show; then we describe step-by-step the calculation techniques presented by the author. Such algorithms are then compared to the ones used in contemporary works, such as the *Liber Alchorismi* and the *Liber Pulueris*, belonging to the tradition of the Latin translation from al-Kwarizmi's *Kitab al-hisab al-hindi* [4, 5], and to the abacus techniques. Under this respect, we also consider and compare the numerals used in some important manuscripts of the *Carmen* to represent the numbers.

Then we broaden our perspective to the spread of new calculation techniques with Indo-Arabic numerals in 12th- and 13th-century France, where the author lived, and in the monastic (maybe Franciscan) environment [6, 7] the author possibly belonged to.

Then we will consider this work in its place in the tradition of the scientific literature both in Latin and in vernacular [8, 9]. A clear distinction will be made in the literature on the topic, based upon target audience and purpose of the various mathematical works of the period (such as, on the one hand, abacus books, devoted to merchants and practical calculations; and, on the other hand, arithmetic inspired to Boethius). In this context, we carefully study the relationship with Sacrobosco's *Algorismus Prosaicus*, as the two works are deeply linked to each other under many respects, such as the title, the period and the place of their composition, the fact that they are often present in the same manuscript.

Again, we consider the *Carmen* in the whole production of the author, which consists mainly in grammatical and religious works; we will also discuss the absolute lack of direct sources about both the author's biography and the *Carmen* history, in order to show that the attribution to the author derives from weak and late evidence.

References

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