

The algebraic content of Bento Fernandes's *Tratado da arte de arismetica* (1555)

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Abstract

The principal aim of this paper is to shed some light on the algebraic content of the *Tratado da arte de arismetica* by Bento Fernandes, which was published in Porto in 1555 and is the earliest treatise of a Portuguese author that has come down to us in which algebra is studied. Since it therefore constitutes an important testimony of the state of development of algebra in Portugal in the middle of the 16th century, it deserves special attention. At a time when Pacioli's *Summa*, the first printed text that includes algebraic methods, was already so diffuse, it is surprising that it turns out *not* to have been the source of the algebraic material of Bento Fernandes. The comparative study I have carried out between the *Tratado da arte de arismetica* and a number of abacus books from the 14th and the 15th centuries shows that Bento Fernandes's algebra had its origin in abacus manuscripts antedating the *Summa*.

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Sumário

O principal objectivo deste artigo é dar visibilidade ao conteúdo algébrico do *Tratado da arte de arismetica*, escrito por Bento Fernandes e publicado no Porto, em 1555. Sendo o primeiro tratado de autor português, que chegou até nós, em que a álgebra é estudada, ele merece uma atenção especial, pois constitui um testemunho do estágio de desenvolvimento da álgebra em Portugal, em meados do século XVI. Numa época em que a *Summa* de Pacioli, a primeira obra impressa contendo álgebra, estava já bastante difundida, é surpreendente que não tenha sido ela a fonte do material algébrico de Bento Fernandes. O estudo comparativo entre o *Tratado da arte de arismetica* e alguns tratados de ábaco dos séculos XIV e XV mostra que a álgebra portuguesa tem a sua origem em textos manuscritos de ábaco anteriores à *Summa*.

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1. Introduction

Bento Fernandes's *Tratado da arte de arismetica* (1555) is one of the first arithmetic works printed in Portugal, and it is the first arithmetic written by a Portuguese author that includes algebraic methods, in particular rules for operating with powers and rules for solving several types of equations.

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Before the *Tratado da arte de arismetica*, two arithmetical treatises had been published in Portugal, both by Portuguese authors. The first of these was Gaspar Nicolás's *Tratado da pratica Darismetyca* (Lisbon, 1519), of which two more Portuguese editions appeared in 1530 and 1541.² The second was Ruy Mendes's *Pratica darismetica* (Lisbon, 1540). Nicolás's and Mendes's works were very useful for merchant activity, and for the commercial practice developed in Portugal in the 16th century [Almeida, 1994, I, 81, 85]. Along with most other contemporary commercial arithmetics they were influenced by Luca Pacioli's *Summa de arithmetica, geometria, proportioni et proportionalità*.³ Nicolás acknowledges the influence of the *Summa* in various passages of the *Tratado da pratica Darismetyca*, considering it essential in solving several problems that he included [Nicolás, 1519, fol. 54v]. However, none of these Portuguese texts contains a treatment of algebraic equations and Nicolás refers critically to the efficiency of the algebraic tools he knew about. In fact, after solving a problem by simple arithmetic, Nicolás adds:

I have already asked this question to an important arithmetician, who told that he knew algebra (...), and in conclusion he has never been able to solve it, and as you see, it is a very easy question (...) [Nicolás, 1519, fol. 42r]⁴

Nicolás was therefore aware of the possibility of solving certain arithmetical problems by algebra, but he chose not to include this subject in his work. On the other hand, although the nationality of the arithmetician that he mentioned is unknown, the reference above might point to the existence in the early 16th century of manuscripts dealing with algebra written by Portuguese authors. Van Egmond has shown that about three hundred manuscripts of Italian origin written prior to 1500 and dealing with arithmetic and algebra have been preserved; we also know twenty-five or so French arithmetic mercantile texts with algebraic content written between 1300 and 1500 [see Van Egmond, 1980, 129; 1988, 129]. But according to Docampo [2004, 546–548], no algebraic texts from before 1500 are known in any of the vernacular languages of the Iberian peninsula. The first algebra book published in Spain or Portugal was Marco Aurel's *Libro Primero de Arithmetica Algebraica* [1552], but there are also some traces of algebraic work in the 50 years preceding its publication. In a recent paper, Docampo [2006] studied a Catalan manuscript from the early 16th century containing notes on arithmetic and algebra that demonstrate that algebra was cultivated in Catalonia before Aurel. Docampo also showed that the author of this manuscript, tentatively identified as Joan Ventallol, freely used Pacioli's *Summa*, including the theory of equations and its applications.

The Portuguese arithmetical treatises of the sixteenth century have been extensively studied by Almeida [1994]. He mentions an earlier arithmetical book composed by Bento Fernandes, which was entitled *Arte de Arismetica* and was purportedly printed in 1541 by Vasco Dias Tanco de Frexenal in Porto; however, Almeida [1994, I, 91–92] states that he has never seen a copy of this work. I have searched for the *Arte de Arismetica* in the archives of the *Biblioteca Nacional de Lisboa*, the *Biblioteca Pública Municipal do Porto*, and various other important Portuguese libraries and archives,⁵ but have not been able to find this work nor any other Portuguese manuscript treatise dealing with algebra and written before Fernandes's *Tratado*.

Almeida claims that, in the *Tratado da arte de arismetica* of 1555, Bento Fernandes follows Nicolás and does not much improve upon him, except that he shows how to solve first and second degree equations. According to Almeida, “Here, he [Fernandes] outdoes Nicolás, who had forgotten in his *Prática d'Arismetyca* the algebraic lessons of the Italian friar [i.e., Pacioli]. This fact documents the dissemination of the *Summa* in Portugal in the first half of the 16th century, because it was, no doubt, the source of algebraic material used by Bento Fernandes, after all the same that Gaspar Nicolás disdained thirty years before” [Almeida, 1994, I, 87].

My study of Fernandes's treatise was thus started with the goal of documenting the extent of its indebtedness to Pacioli's *Summa*, although certain characteristics of the Portuguese text, especially the total absence of symbolic notation except for natural numbers and fractions, made me wonder whether its sources were not older than the

² The *Tratado da pratica Darismetyca* (Lisbon, 1519) is available in a facsimile edition including a bibliographical note and a comment about the work and its author by Luís Mendonça de Albuquerque [Albuquerque, 1963].

³ We may mention, for example, the influence of Pacioli's *Summa* on Juan Andrés's *Sumario Breve de la practica de la Arithmetica de todo el curso de larte mercantívol bien declarado: el qual se llama maestro de cuento*, printed in Valencia in 1515 [see Docampo, 2006, 45] and on Ventallol's *Pràtica mercantívol*, printed in Lyon in 1521 [see Docampo, 2004, 538–539].

⁴ Here and elsewhere, the translations into English are my own if nothing else is indicated.

⁵ These included the following: Arquivo Nacional da Torre do Tombo, Biblioteca do Palácio da Ajuda, Arquivo Histórico do Porto, Biblioteca Pública de Braga, Arquivo Distrital de Braga, Biblioteca Pública de Évora, and Biblioteca Geral da Universidade de Coimbra.

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