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the sources of Pérez de Moya's*
Tratado de Arithmetica *(1573)*

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ON THE CIRCULATION OF ALGEBRAIC KNOWLEDGE IN THE IBERIAN PENÍNSULA: THE SOURCES OF PÉREZ DE MOYA'S *TRATADO DE ARITHMETICA* (1573)

Maria do Céu Peireira da Silva

Abstract. — This paper focuses on the algebraic contents of Juan Pérez de Moya's *Tratado de Arithmetica* [1573]. The author, who was the main disseminator of algebra in 16th century Spain, carefully reviewed his previous algebraic works, and implemented substantial improvements in them. The comparative study we have carried out with some of the best known algebraic works from the Renaissance has allowed us to identify the main algebraic sources of Moya. In particular, this article shows that Moya read carefully Tartaglia's *General Trattato* [1560], Nunes' *Libro de Algebra* [1567], and Stifel's *Arithmetica Integra* [1544], and it throws a new light on the algebraic culture in the Iberian peninsula during the last third of the sixteenth century.

Résumé (Sur la circulation des connaissances algébriques dans la Péninsule ibérique ; les sources du *Tratado de Arithmetica* de Pérez de Moya)
Cet article est centré sur le contenu algébrique du *Tratado de Arithmetica* [1573] de Juan Pérez de Moya. L'auteur, qui a été le principal vulgarisateur de l'algèbre en l'Espagne au xvie siècle, a examiné minutieusement ses précédents travaux algébriques, et a apporté des améliorations significatives en

eux. L'étude comparative que nous avons menée avec quelques-unes des plus connues œuvres algébriques de la Renaissance nous a permis d'identifier les principales sources algébriques de Moya. En particulier, ce document montre que Moya a lu attentivement le *General Trattato* [1560] de Tartaglia, le *Libro de Algebra* [1567] de Pedro Nunes et l'*Arithmetica Integra* [1544] de Stifel, et il apporte un nouvel éclairage à la culture de l'algèbre dans la péninsule ibérique au cours du dernier tiers du seizième siècle.

1. INTRODUCTION

In 1573, the Spanish mathematician Juan Pérez de Moya published in Alcalá de Henares the *Tratado de Mathematicas*, surely the most authoritative treatise of Mathematics printed in Portugal and the Hispanic kingdoms in the sixteenth century[1]. This work consists of three parts, the first of which, the *Tratado de Arithmetica*, is devoted to arithmetic and algebra. The seventh chapter of the first part consists of an extensive study of algebra[2]. Up to that moment, Pérez de Moya had published the *Compendio dela regla dela cosa, o Arte Mayor* [Pérez de Moya 1558], the first printed work of an Iberian author entirely devoted to algebra, and the *Arithmetica practica, y speculativa* [Pérez de Moya 1562], where algebra is studied in an extensive chapter[3]. The *Arithmetica practica, y speculativa* became a reference in Spain during the sixteenth century and the following centuries. We can not state the exact number of times it was printed, since half a dozen works of Moya have this same title and the same content, but they do not display date or printer mark[4]. Nevertheless, we can ensure that after 1562 it was reprinted, at least, twenty-five times: four times in the sixteenth century, eleven times in the seventeenth century, ten times in the eighteenth century, not to mention the *Arithmetica practica, y speculativa* edited in the twentieth century by Consolacion Baranda[5].

According to Docampo [2009, p. 124], the Catalan manuscript Ms. 71 of Sant Cugat (*Arxiu de la Corona d'Aragó*, Barcelona), dated to around 1520, contains the first known account of algebra in a vernacular Iberian language. At that time, Joan Andres's *Sumario breve de la pratica de la Arihtmetica* [Andres 1515] had been published in Spain and Gaspar Nicolas's

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[1] For a biography of Moya see [Valladares Reguero 1997].

[2] [Pérez de Moya 1573, pp. 429-605].

[3] [Pérez de Moya 1562, pp. 443-615].

[4] See [Silva 2011, p. 23].

[5] [Baranda 1998].

Tratado da Pratica Darismetyca [Nicolas 1519] in Portugal. The authors of these two mercantile arithmetics had heard of the existence of algebra, but both looked at it with suspicion [Silva 2011, p. 188]. In a previous paper, Docampo [2006, pp. 51- 52] says that the Catalan manuscript of Sant Cugat uses mostly the notations from Pacioli's *Summa*, and includes many topics from it, such as a theory of equations and algebraic fractions. Pacioli's *Summa* and Euclid's *Elements* were the main references for the Iberian authors in 16th century [Romero Vallhonesta 2012, p. 120].

By the time Pérez de Moya wrote the *Compendio dela regla dela cosa* [1558], Pacioli's *Summa* [Pacioli 1494] was well disseminated in the Iberian peninsula. Moreover, Marco Aurel had published the *Libro primero de Arithmetica Algebratica* [1552], which was the first Spanish work containing algebra, though its arithmetic part occupies half of the work. We stress that Moya and Aurel wrote in Spanish in order to reach a wide audience, not necessarily skilled in mathematics. The algebraic content of all these Spanish arithmetics is very similar: they state the characters representing the unknown and other notations to be used, study different types of equations and the rules to solve them, deal with square and cube roots of binomials and residuals, and apply these insights to solve a lot of problems. In addition they include the method of using a second unknown. Heeffer [2010, p. 60] believes that this method "is an exception in algebraic practice before 1560". With very small differences this is also the content of the algebraic *Libro Septimo* of Pérez de Moya's *Arithmetica practica, y speculativa* [1562].

Less known but also important for the history of Iberian algebra in the 16th century is the Portuguese merchant Bento Fernandes's *Tratado da arte de arismetica* [Silva 2008]. It is the earliest published treatise in Portuguese that contains algebra. Fernandes works with roots, powers and polynomials, and solves several types of equations, but he uses no symbolic notation except for natural numbers and fractions. The *Tratado da arte de arismetica* essentially drew on Italian abacus manuscripts from the early 15th century, but the possibility of an Arabic influence should not be excluded [Silva 2008, p. 211].

Leitão [2002, p. 410] dates to around 1535 or 1536 the original manuscript of Pedro Nunes's *Algebra*. He says that this text originally written in Portuguese was gradually extended until about 1564, then being translated into Spanish, and published [Nunes 1567]. Leitão also recalls [2010, p. 11] that shortly after being published and during all the 17th century Nunes' *Libro de Algebra* was very widespread; however, among those who knew Nunes' work, he does not mention any Spanish author