‘Magic is No Magic’
The Wonderful World of
Simon Stevin

WIT PRESS

WIT Press publishes leading books in Science and Technology.
Visit our website for the current list of titles.
www.witpress.com

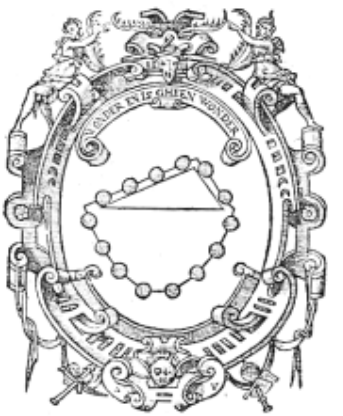
WIT eLibrary

Home of the Transactions of the Wessex Institute, the WIT electronic-library provides the international scientific community with immediate and permanent access to individual papers presented at WIT conferences. Visit the WIT eLibrary at
http://library.witpress.com

The only portrait of Stevin was probably painted shortly after he died. In the top left and right corners are the dates and places of his birth and death.

Leiden, University Library, Special Collections

‘Magic is No Magic’
The Wonderful World of
Simon Stevin



Authors:

Jozef T. Devreese
University of Antwerp, Belgium

Guido Vanden Berghe
Ghent University, Belgium

WITPRESS Southampton, Boston

Jozef T. Devreese
University of Antwerp, Belgium

Guido Vanden Berghe
Ghent University, Belgium

Translated by Lee Preedy
Cover concept: Sara Van Gucht
Graphics: Vladimir Gladilin
Design: Keith Godwin
Cover photo: © Davidsfonds Publishers (Daniël Geeraerts).

Published by

WIT Press
Ashurst Lodge, Ashurst, Southampton, SO40 7AA, UK
Tel: 44 (0) 238 029 3223; Fax: 44 (0) 238 029 2853
E-Mail: witpress@witpress.com
http://www.witpress.com

For USA, Canada and Mexico

WIT Press
25 Bridge Street, Billerica, MA 01821, USA
Tel: 978 667 5841; Fax: 978 667 7582
E-Mail: infousa@witpress.com
http://www.witpress.com

British Library Cataloguing-in-Publication Data

A Catalogue record for this book is available
from the British Library

ISBN-10: 1-84564-092-6
ISBN-13: 978-1-84564-092-6

Library of Congress Catalog Card Number: 2006934780

Printed in Great Britain by Athenaeum Press Ltd.

Dedications

Dedicated by Jozef T. Devreese to:

Rose-Marie, Jeroen,

Gert, Veronique, Sarah, Charlotte, Jorik,

Annemie, Jacques, Jessica, Stefanie, Jasper, Jana

Dedicated by Guido Vanden Berghe to:

Magda,

Kristof, Beatrijs, Hanne, Lore, Quinten, Tine,

Stefaan, Caroline, Machteld, Michiel, Marthe, Hermelien,

Jeroen, Griet, Jona,

Elke, Peter, Lotte, Robin,

Maaike, Stijn,

Maarten,

Hannes

Contents

Foreword

The decimal number system, using a decimal place followed by digits ranging from 0 to 9, in order to characterize any number with any desired accuracy, is so familiar to most of us that one might forget that it actually had to be invented by someone. This someone also had to find out how to add, subtract, multiply and divide such numbers. His name is Simon Stevin, an ingenious physicist and mathematician born in Bruges in the sixteenth century. The word 'dime' stems directly from 'disme', an English translation of 'thiende', or 'tenth', as introduced in Stevin's work. That and many other aspects of his many-sidedness and versatility can be found in this book.

Stevin's contributions cover a range of disciplines: mathematics and physics, engineering and technology, navigation, financial theory, fortifications and city planning, linguistics, theory of music, etc. He was one of the very first 'Copernicans', while at the same time he took part in the ethical discussions of his time, advocating tolerance and civic spirit, and furthermore he created an Engineering School. Stevin's books, several of them published by the humanist master printer Christopher Plantin and his son-in-law, use strong and innovative visual representation as a tool of generating and disseminating new science. In the present book this spectrum of endeavours by Stevin and their historical setting in the Renaissance is presented for a broad audience.

The authors, Jozef T. Devreese and Guido Vanden Berghe, profoundly studied the works of Stevin and their impact. As physicists the authors based their study on the objective analysis of existing material. Interpreting the objective data they concluded that Stevin's work merits to be known, not only by specialists but also by a wide public.

The Scientific Revolution is sometimes considered to have been initiated in 1543 with Copernicus's *'De Revolutionibus'*, even when the heliocentric world picture was known to Aristarchos around 300 BCE. Stevin is often cited as one of the links in the chain of progress leading from Copernicus via Kepler, Gilbert and Galileo to Newton and Huygens. As scientists we stress the significance of Stevin's explicit requirement of the combination of theory and experimental verification, in his words *'Spiegheling en Daet'*. It is not commonly realised that Stevin, in his treatise on hydrostatics was one of the first to stress this point. It is this systematic testing of theory using experiment that constitutes a key difference between the science of the ancient Greeks and the modern scientific method. One of the reasons why Greek science came to a halt was that the ideas of leading philosophers were accepted as decisive, while empirical tests were barely pursued. Historians of science have devoted extensive studies to this problem of the decline of Greek science after

Archimedes. As many as 1,800 years passed before first Simon Stevin and subsequently Galileo, who went a step further, succeeded to open new avenues in mechanics, beyond the achievements of the Greeks.

Stevin should be credited for his recognition of the need for standard units (of length, weight, mints, etc) and his making of a plea for those units, in a time when a great variety of different systems were used leading to great confusion. The introduction and use of standard units is a very hard task. It took till the French Revolution before the metric system took off. Even today miles, inches, and pounds are still being used in most parts of the Anglo-Saxon world.

An example of a fascinating theme touched upon in the present book concerns the *perpetuum mobile.* The idea has it roots in the Orient. In the Middle Ages and during the Renaissance period, there was widespread interest in the *perpetuum mobile* (that we would call today 'of the first kind'). Leonardo da Vinci had explored the concept of perpetuum motion machines; he made some sketches of imaginary machines, and took a sceptic attitude regarding their practical realization. Stevin formulated the negation of the possibility of a *perpetuum mobile* as a law of nature and from it he drew several conclusions, such as the law of the inclined plane. He came close to the crucial concept of energy in his famous thought experiment which he devised for the inclined plane. Subsequently Galileo and Huygens, in their works, also used this negation of the *perpetuum mobile.*

Stevin's main contributions to physics were realized in a short period between 1581 and 1586, a period in which he already devoted considerable efforts to engineering. After 1586 he expanded his activity to many fields as described in several chapters in this book.

The reader will find a very accessible account of Stevin's multiple activities and findings, and how those efforts fit into the broad picture of progress during the Renaissance. *'Magic is No Magic'. The Wonderful World of Simon Stevin* also incorporates the new insights that came to light after earlier bibliographic works on Stevin had appeared (1943-1966).

I am convinced the reader will find this book about Simon Stevin enjoyable and accessible.

Prof. Dr. Gerard 't Hooft,
Nobel Laureate for Physics (1999)

Preface

Wonder en is gheen wonder – **'Magic is No Magic'** – expresses Simon Stevin's vision of science. According to Stevin a natural phenomenon is only 'magic' as long as it is not understood. As soon as it is grasped, it is '**no magic**'. This is a very pragmatic motto that appears on the title pages of many of Stevin's works, and with which Stevin perhaps contrasted his approach with the scholastic.

Dozens of times each day the drivers of the horse-drawn carriages that convey tourists around Bruges extol Simon Stevin as they pass his statue: 'He was a great mathematician, physicist and engineer, inventor of the decimal system and,' they sometimes add, 'of the sailing chariot'. 'Mathematician and physicist', we read, on the sign that bears the name of the square where his statue stands, the Simon Stevinplaats.

Numerous societies in Flanders and the Netherlands are named after him, including sailing clubs, organizations concerned with the conservation of fortifications, schools, observatories and student associations. His name is attached to important prizes, journals, streets, sluices and many more and diverse things. Less well known to the general public is the fact that Stevin was an intellectual all-rounder who made significant contributions in numerous disciplines.

Internationally, Stevin is chiefly known in academic and scientific circles of various specialities. His name is to be found in select lists of the seven or so pioneers in the history of the computer and is included on the famous 'Printing and the Mind of Man' list, which highlights books which have had a significant impact on history in general.

Stevin was already renowned in his own day and men of learning in various disciplines were well aware of his work. Yet it was to be a long time before the Bruges scholar and his manifold contributions received the public recognition they merited. In recent decades there has been a growing interest in Stevin's work, but even today the resonance of his name is not commensurate with his achievements.

Physics provides a case in point. As is underlined in this book, Stevin's name should be associated with at least two important laws. In hydrostatics some of the credit that is rightly Stevin's is given to Pascal, while the composition law of forces has become such a fundamental fact that no individual scholar's name is associated with it, although – for the general case – it was actually propounded by Stevin. And though Newton is indisputably the creator of modern physics, Simon Stevin was one of those who paved the way for the modern science.

The purpose of this book, however, is not the scientific study and definition of Stevin's priority in discoveries and inventions, though modern insights into these things are covered. Its main aim is to introduce Simon Stevin and his work to the widest possible readership. In doing so, the authors have kept to established historical facts and critically underpinned scientific insights into Stevin and his work.

To date, apart from short essays on single aspects of his work, two standard works on Stevin have appeared: *Simon Stevin* by Eduard Jan Dijksterhuis (1943) and *The Principal Works of Simon Stevin,* published in five volumes between 1955 and 1966, an initiative of the Koninklijke Nederlandse Academie van Wetenschappen. *The Principal Works* reproduces most of Stevin's works, with an English translation and introductory commentary. These standard references are extremely valuable, and are essential sources for those wanting to study Stevin. They are aimed particularly at specialists in one or other of the many disciplines Stevin practiced. In addition, since 1943, and respectively in 1966, our picture of Stevin has been filled out with many new insights and discoveries. Thus our purpose here is to introduce Stevin's oeuvre in an accessible way with today's insights taken into account.

Particular attention is devoted to the more recent insights into Stevin's work, which appear in virtually every chapter. As a rule these are not gone into in detail: often they are situated succinctly and the interested reader is referred to the appropriate source. For instance, a lengthy chapter could have been written about Stevin's posthumously published work on architecture, *De Huysbou.* Such a chapter could have been based partly on the research of Charles van den Heuvel. Instead, when preparing the original, Dutch version of this book, we opted for a brief reference to this work, as in 2003 that author's extensive work on the *Huysbou* was still in preparation.

For each of the subjects discussed the background, the significance, the impact and the status of Stevin's contribution are analysed and interpreted.

Archive-browsing has resulted in the discovery of additional references to Stevin's presence in the army camps during Maurice of Nassau's campaigns (Chapter Four). Also in the present volume we have included reproductions of Stevin autographs of the *Singconst* which, as far as we know, have hitherto only appeared as transcriptions in the literature (Chapter Eleven).

The polymathic nature of the Bruges scholar is immediately striking. Stevin dealt in a profound and creative way with a multiplicity of subjects, often using innovative didactic design. This is reflected in the structure of this book, with chapters devoted to extremely diverse subjects and specialities. After situating Stevin as a true *homo universalis* and looking at his life and family, we examine his original and innovatory contributions chapter by chapter. The reader will get to know the man behind the introduction of decimal fractions, the engineer and inventor with his numerous patents, the economist *avant la lettre*, the brilliant physicist who also contributed to the mathematics of his day. Subsequently we look at Stevin's contribution to his own Dutch language, and at his crystal clear contribution to the theory of perspective and music. A special chapter deals with Stevin's exceptional pedagogic genius and his 'visible language', which is receiving much attention

today. Finally the resonance of Stevin's work is discussed.

It will be obvious to the reader that given the way science works today it would be impossible for a single individual to make meaningful contributions in so many areas.

We have done our utmost to ensure that every chapter can be enjoyed by everyone. None the less, Chapters Six and Seven will perhaps be appreciated more by those who did not altogether abandon science in secondary school. As Menaechmus reputedly pointed out to Alexander the Great when the ruler asked for a shortcut in geometry, there is no royal road; everyone must travel the same way.

This fact was also recognized by Maurice of Nassau, Prince of Orange, who made great efforts to master the science and technology of his day, and who chose Stevin as his permanent tutor and councillor. The relationship between Stevin and Maurice is not explored in depth in this book. In 2000 the excellent *Maurits, Prins van Oranje* (Kees Zandvliet, 2000) appeared, in which the interaction between the polymath and the prince is discussed in detail. However, the important new insights into Stevin's status at Maurice's court that follow from this publication are explained in the present volume.

For the authors, both of whom have their roots in Bruges, an interest in Simon Stevin has grown gradually, as a sort of hobby. From 1990, separately at first and then jointly, both organized events based on Stevin and his work: lectures, short publications, exhibitions on Stevin, and, in 1998, together with Dr Charles van den Heuvel, a symposium in Bruges. The wealth of Stevin's world of ideas, the multifaceted nature of his approach and the subjects he dealt with, his probing and aesthetic didactic designs, and the situating of Stevin in the Renaissance period, made this exploration a unique and most fascinating experience.

We hope that we can pass on to the reader something of this contact with the Bruges scholar and his world in **'Magic is No Magic'. The Wonderful World of Simon Stevin.**

The Authors

Acknowledgements

Simon Stevin's multifaceted nature is also reflected in the many contacts we have had in the creation of this book, and it is a great pleasure now to express our thanks. In the first place we thank Dr Charles van den Heuvel, art historian, Senior Researcher Koninklijke Nederlandse Academie van Wetenschappen and, in connection with Stevin, specialist in the areas of architecture (theory), town planning, fortification and civil technology. He has a particular interest in Stevin's manuscripts and transcriptions thereof, and in the reception of this written heritage. We had several fruitful exchanges of ideas with Dr van den Heuvel. He provided us with numerous interesting references, documents and data, and was kind enough to read an early version of our manuscript.

We are grateful to Sara Van Gucht, whose suggestions contributed significantly to the content and presentation of the book. As a high-school teacher of History and English, her grasp of the historical and didactic aspects of the text and their resonance in the Anglo-Saxon world not only enhanced the style, clarity and accessibility of the original Dutch version, but also set out a sound basis for the English translation.

We are indebted to Dr Koos van de Linde, an authority on the organ, for rewarding conversations regarding the history of tuning theory.

We also thank those who through discussions, critical commentary and the provision of data or assistance have contributed to the creation of this book:

Ludo Vandamme, scientific associate, Historical Collections of the City Library (Biekorf) Bruges; Professor Dr Carl Reyns, Universiteit Antwerpen, Former Rector Universiteit Antwerpen (UFSIA), professor of financial accounting; Dr Marjolein Kool, Hogeschool Domstad, Utrecht, teacher of arithmetic/mathematics and pedagogics; Dr Nicoline van der Sijs, University of Utrecht, etymologist and publicist on language; J.P. Puype, conservator, Army Museum, Delft; Professor Dr Fons Brosens, Universiteit Antwerpen, physicist; Christiane Broos, teacher of physics; Professor Dr Guido de Baere, Universiteit Antwerpen, professor of religious hermeneutics; Professor Emeritus Dr Ludo Simons, Universiteit Antwerpen, professor of book and library science at the Universiteit Antwerpen and Katholieke Universiteit Leuven, Honorary Chief Librarian of the Universiteit Antwerpen; Dr M. De Reu, keeper of manuscripts and rare books, Universiteit Gent; Professor Dr Pierre Delsaerdt, professor of book and library history at the universities of Antwerp and Leuven. Head of the Department of Library and Information Sciences at the Universiteit Antwerpen; Julien van Borm, Universiteit Antwerpen, Chief Librarian of the Universiteit Antwerpen; Francis Wray MA, PhD (Cantab), Technology Transfer Consultant; Dr M.A. Mooijaart, editor-in-chief *Woordenboek der Nederlandsche Taal*, Instituut

voor Nederlandse Lexicologie (Leiden); Professor Dr Josse Van Steenberge, Universiteit Antwerpen, President of the Association of the University - Higher Education Colleges Antwerp, Former Rector Universiteit Antwerpen (UIA), professor of social security law, Universiteit Antwerpen; Professor Dr Francis Van Loon, Rector Universiteit Antwerpen, professor of statistics; J. Dhondt (City Archive, Bruges); Professor Emeritus Dr Roland Baetens, Universiteit Antwerpen, historian; Professor Dr Vladimir Fomin and Dr V. Gladilin who also contributed to the logistics of the editing process, physicists, Universiteit Antwerpen and Moldova State University; Yola de Lusenet, Edita of the Koninklijke Nederlandse Academie van Wetenschappen (Amsterdam); Dr iur. P. Van Remoortere, former President of the Universiteit Antwerpen (UIA); Professor Dr Georges Wildemeersch, professor of Dutch Literature, Universiteit Antwerpen; Dr Ike van Hardeveld, Poppel (Belgium); N. Blontrock (VRT and press journalist); Professor Dr E. Coppens (University of Nijmegen); J. Kok (Elsevier Science); Professor Dr G. Van Hooydonck, Universiteit Gent; Professor Dr H. Symoens, Universiteit Gent; the late Professor Dr Jozef Brams, Institute of Philosophy, Katholieke Universiteit Leuven; Mrs C. De Smedt, Merchtem; Professor Dr R. Beyers, Universiteit Antwerpen, Department of Romance Languages and Latin; P. Donche, Universiteit Antwerpen; Professor Dr Alain Verschoren, President Universiteit Antwerpen, Former Rector Universiteit Antwerpen (RUCA), professor of mathematics.

We thank the collaborators of the Davidsfonds and WIT Press Publishing Houses for their contributions to the design of the Dutch and English editions of this book, respectively.

The authors are pleased to express special thanks to Lee Preedy for her outstanding translation from Dutch to English of our original book *'Wonder en is gheen wonder'. De geniale wereld van Simon Stevin 1548-1620* (Davidsfonds, Leuven, 2003 - ISBN 90-5826-174-3). Ms Preedy's contribution was not limited to the translation of the original text, but also included the discussion and refinement of several points, their historical context and factual accuracy.

The publication of the original Dutch edition of this book, *'Wonder en is gheen wonder'. De geniale wereld van Simon Stevin 1548-1620,* was made possible through the support of a number of individuals, companies and institutions, to whom we express our thanks. Professor Dr Ir. Jef Roos, Honorary Chairman VEV, Chairman UGINE & ALZ-Belgium NV. Dr Ludo Verhoeven, Past President and Chairman of the Board of AGFA-GEVAERT NV, Honorary Chairman of the VEV. AGFA's support made possible the inclusion of the colour reproductions in the original Dutch edition of this book. The Fonds voor Vlaanderen who sponsors projects on the theme of 'Fleming, who are you? Highs and Lows in our History'. The Marnixring Internationale Service Club VZW who encourages the Dutch language irrespective of political and philosophical borders. Ir. Herman Deroo, retired General Chairman of the KVIV. The Koninklijke Vlaamse Ingenieursvereniging (Royal Flemish Society of Engineers) supported the publication of the original Dutch edition of this book to mark its sevety-fifth anniversary. The KVIV regards Simon Stevin as the first university trained engineer and as a pioneer for the many who follow in his footsteps today. The Laboratory for Theoretical Solid State Physics (TFVS) of the University of Antwerp.

Note to the reader

Virtually every subject that Stevin turned his attention to resulted in a written work. His output was prolific and many of his texts were published, either by himself, by his son Hendrick, or by others. Many of his works were also translated into European vernaculars or Latin.

Even though the Dutch of Stevin's day will probably be unfamiliar to many readers it was decided to leave the titles of Stevin's works in their original languages. Where a title appears for the first time a translation follows in brackets. A list of titles with an English translation will be found on page numbers xxiii-xxviii.